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MEDICAL ENTOMOLOGY STUDIES - XV.  
A REVISION OF THE SUBGENUS *PARAEDES* OF  
THE GENUS *AEDES*  
(DIPTERA: CULICIDAE)

by

John F. Reinert

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(DIPTERA: CULICIDAE)<sup>1</sup>

By

John F. Reinert<sup>2</sup>

ABSTRACT

The subgenus *Paraedes* Edwards of *Aedes* Meigen is revised. *Paraedes* includes 8 currently recognized species that are restricted to the Oriental region. All known stages of *barraudi* (Edwards), *bonneae* Mattingly, *chrysoscuta* (Theobald), *collessi* Mattingly, *menoni* Mattingly, *ostentatio* (Leicester), *pagei* (Ludlow) and *thailandensis* Reinert are described and illustrated, and are included in identification keys. The range and mode of setal branching of the pupae and larvae are given. Geographical distribution, bionomics, type-data and taxonomic discussions are presented for each species. *Aedes chrysoscuta* is resurrected from synonymy with *ostentatio*. *Aedes aurotaeniatus* Edwards is excluded from the subgenus *Paraedes*.

INTRODUCTION

Edwards (*in Barraud 1934: 446*) described the genus *Paraedes* from specimens of 2 species, *barraudi* (Edwards) and *argyrurus* (Edwards). His association of these 2 species and the basis of the new genus was based primarily on the absence of setae on the upper calypter of the wing. The latter species was removed from *Paraedes* by Thurman (1954: 84) and placed in *Udaya*, a then new subgenus of *Aedes* Meigen. Mattingly (1958a: 4, 19) elevated *Udaya* to generic status and reduced *Paraedes* to subgeneric rank within *Aedes*. Species currently recognized in the subgenus *Paraedes* have previously been assigned to the following genera and/or subgenera: *Aedes* Meigen, *Aedimorphus* Theobald, *Aioretomyia* Leicester, *Danielsia* Theobald, *Ochlerotatus* Lynch Arribalzaga, and *Pseudohowardina* Theobald.

*Paraedes* includes 8 distinct species (Table 6) and is distributed throughout the Oriental zoogeographical region. The present revision redefines the subgenus and presents characters for distinguishing it from the other subgenera of *Aedes*.

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Identification keys are given for separating the adult females, male genitalia, pupae and larvae for the known stages of the included species. All known stages of each species are described and illustrated. The males, male and female genitalia, pupae and larvae of *chrysoscuta* and *ostentatio* are described and illustrated for the first time.

*Aedes aurotaeniatus* Edwards was transferred from the subgenus *Stegomyia* Theobald to the subgenus *Paraedes* by Huang (1970: 281). This transfer, I believe, was based on superficial characters that do not reflect phylogenetic affinities. Huang (page 287) stated "... the male terminalia of *aurotaeniatus* appears to have some rather basic genitalic characters in common with *Paraedes*, suggesting a close affinity." I have examined the 2 male specimens (456-100, -105) and the other material reported by Huang and found the male genitalia to be significantly different from all known species of *Paraedes* in the phallosome, basal mesal lobe, proctiger, gonocoxite, gonostylus, tergum IX and sternum IX. Furthermore, many features of the adult and pupae of these specimens are not equivalent to the species included here in the subgenus *Paraedes*. A comparison of the description by Huang (1970) of *aurotaeniatus* and that of the subgenus *Paraedes* presented here clearly indicates that *aurotaeniatus* does not belong with the other species of *Paraedes*. *Aedes aurotaeniatus* will be treated in detail in a separate publication.

The abbreviations used in the literature cited section conform to the BIOSIS List of Serials, Biosciences Information Service of Biological Abstracts, Philadelphia, 1972. In the synonymy sections, an asterisk following the abbreviations used ( $\varphi$  = female,  $\sigma$  = male, P = pupa, L = larva) indicates that at least some portion of that sex or stage is figured. In the distribution sections, the abbreviations used are the same as in the synonymy sections, but with the following 2 additions: p = pupal exuvium and l = larval exuvium. In the pupal descriptions and tables the number of branches of abdominal seta 1-I was counted on the basal third of the seta; therefore, only primary branches are recorded. The scale for the illustrations is in millimeters. Distribution records are indicated as follows: countries are in capital letters, provinces and primary administrative divisions are in italics, and place names are with the first letter capitalized. The number of specimens examined from each province follows the place name of the province in the distribution section. The spelling of provincial and locality names was taken from the following Official Standard Names Gazetteers prepared by the Geographic Names Data Base Division, Defense Mapping Agency and the Office of Geography, U. S. Department of the Interior: Malaysia (1970); Philippine Islands (vols. I and II, 1953); South Vietnam (1971); Sri Lanka (= Ceylon) (1960); and Thailand (1966). Locality names which did not appear in the gazetteers were spelled according to the collection data sheets and labels on the specimens.

Information in the bionomics and distribution sections was taken from the collection data sheets and specimen labels of the specimens that I examined and from the published literature. In the type-data sections information within brackets [ ] is additional to that included on the original specimen labels.

Nomenclature and chaetotaxy used for the female, male, male genitalia, pupa and larva follow Knight (1970, 1971), Knight and Laffoon (1970a, 1970b, 1971a, 1971b), Laffoon and Knight (1973) and Harbach and Knight (1978a, 1978b). The terminology of the female genitalia follows Reinert (1974). The term *scape index* is defined as the ratio of the length of the larval antennal scape to its width at the point of attachment of seta 1-A (Reinert 1979: 152).

**GENUS AEDES MEIGEN**  
**SUBGENUS PARAEDES EDWARDS**

Type species: *Paraedes barraudi* Edwards

*Aioretomyia* in part of Leicester 1908: 185.

*Pseudohowardina* in part of Theobald 1910: 227.

*Danielsia* of Ludlow 1911: 128.

*Ochlerotatus* in part of Edwards 1913: 228; Brunetti 1920: 133; Senior-White 1923: 72.

*Aedes* (*Aedes*) in part of Dyar and Shannon 1925: 78; Edwards 1928: 53, 1929: 3.

*Aedes* (?*Aedimorphus*) of Barraud 1928: 374, 1934: 267; Edwards 1932: 171.

*Paraëdes* Edwards, in Barraud 1934: 446.

*Aedes* (*Aedimorphus*) in part of Bohart 1945: 63; Carter 1950: 89; Knight and Hull 1953: 453; Chow, Thevasagayam and Tharumarajah 1954: 117.

*Paraëdes* of Thurman 1954: 83 (in part); Mattingly 1971: 1.

*Aëdes* (*Paraëdes*) of Mattingly 1958a: 4, 19, 1958b: 76, 1958c: 106.

*Aedes* (*Paraedes*) of Stone, Knight and Starcke 1959: 199; Stone and Delfinado 1973: 306; Knight and Stone 1977: 147.

**MALE.** *Head.* Antenna 0.89-1.30 length of proboscis, lightly plumose with setae of whorls long and evenly spaced around shaft, pedicel with a few small scales and short fine setae mesally, maxillary palpus dark scaled, short, 0.09-0.12 length of proboscis; clypeus bare; proboscis dark scaled, 0.87-1.14 length of femur I; vertex covered with broad decumbent dark scales; occiput with a few erect forked scales; eyes contiguous or separated. *Thorax.* Scutal integument dark; scutum covered with narrow curved dark scales, narrow curved pale scale patterns present or absent; prescutellar bare space without scales; scutal setae as follows: 2-5 anterior promontory, scutal fossal [2-5 anterior, 1-4 lateral, 0-2 (usually 1) posterior], numerous dorsocentral (anterior and posterior), acrostichal absent (except in *barraudi* which has 3, 4 anterior), numerous supraalar, 4-6 posterior medial scutal, and 1 postalar callar; scutellum with narrow curved and/or broad scales, 4-11 setae on median lobe and 2-6 setae on lateral lobe; pleural integument usually dark; antepronota widely separated, each with narrow curved, and/or broad scales, 5-14 setae; postpronotum with narrow curved, and/or broad scales, 3-7 posterior setae; propleuron with broad scales, 3-8 setae (*thailandensis* with 14-22 setae); prosternum, subspiracular area, mesomeron, metameron and mesopostnotum bare; paratergite usually bare (scaled in *thailandensis*); postspiracular area with or without scales, 1-4 setae; mesepisternum with a patch of broad scales on both upper and lower areas, 1-4 upper and 6-15 posterior setae; prealar knob without scales, 4-12 setae; mesepimeron with a patch of broad pale scales, 6-15 setae dorsad of scales. *Legs.* Tibiae I-III and tarsi I-III dark scaled; post-tarsi I, II with unguis equal in size, toothed or simple, III with unguis equal in size and simple. *Wing.* Alula with a single row of scales on margin; 1, 2 remigial setae; upper calypter with or without setae on margin. *Abdomen.* Terga dark scaled, I with a rectangular patch of pale scales on laterotergite, II-VII with a laterobasal pale scaled patch. *Genitalia.* Tergum IX covered with minute spicules, bilobed, with 2-9 setae on each lobe; gonocoxite moderately long and moderately broad, tergal surface basomesally with a patch of setae, sternal surface apicomesally with a patch of long setae, scales present; gonostylus long, attached at apex of gonocoxite, bifid (trifid in *bonneae*), one or 2 of arms with spicules forming file-like ridges, one arm with short fine setae, spiniform absent; basal mesal lobe connected to gonocoxite at base of mesal

membrane, well developed, with 2 arms, one arm long, narrow, curved and with 3 stout apical setae (apices usually recurved), other arm broader, with 3-5 flattened apical or subapical setae or with a number of spines (*chrysoscuta* and *ostentatio*), basal mesal lobe connected mesally to its mate by a band that is covered with short spicules; proctiger short, apex of paraproct curved tergally as a blunt heavily pigmented point, cercus membranous with a moderately large and moderately pigmented dorsal plate, setae absent; phallosome with aedeagus divided into 2 lateral plates each with up to 3 stout teeth, paramere long, 0.80-1.02 length of lateral plate of aedeagus, parameral apodeme long and narrow; and sternum IX covered with minute spicules, 2-4 (usually 2) long stout setae.

**FEMALE.** Essentially as in male but with the following differences. *Head.* Antenna 1.14-1.52 length of proboscis; maxillary palpus 0.16-0.23 length of proboscis; proboscis 0.75-1.14 length of femur I; vertex with narrow curved pale scales forming a triangular patch or forming a line along coronal suture, with or without erect forked scales. *Thorax.* Pale scale patterns, when present, usually better developed than in male; paratergite bare (scaled in *thailandensis* and *pagei*); setal differences as follows: 2-6 anterior promontory, scutal fossal (2-6 anterior and 1-5 lateral), 0-4 (usually absent) anterior acrostichal, scutellar (5-13 on median lobe and 4-11 on lateral lobe), 7-15 antepronotal, 4-16 propleural, 1-7 postspiracular, 1-4 upper and 7-18 posterior mesepisternal, 4-13 on prealar knob, and 6-18 upper mesepimeral. *Legs.* Posttarsi I-III with unguis equal in size, toothed or simple. *Wing.* Upper calypter with setae on margin. *Genitalia.* Tergum VIII covered with minute spicules, moderately pigmented, scales usually absent (0-2 scales in *chrysoscuta*), basal 0.7-1.0 retracted into segment VII, base concave mesally, apex straight or slightly convex, several to numerous short setae scattered over apical 0.46-0.94, setae along apex short and thin, some species also with moderately long thin setae apically, basolateral seta present or absent (usually absent), VIII-Te index 0.56-1.12, VIII-Te/IX-Te index 1.73-2.65, length 0.15-0.28 mm, width 0.22-0.34 mm; sternum VIII covered with minute spicules, moderately pigmented (*thailandensis* and *menoni* with a large lightly pigmented median area), scales usually absent (0-4 scales in *pagei*), base concave mesally, apex usually with a moderately deep median indentation (0.11-0.22 of length) (*bonneae* and *menoni* with only a small indentation, 0.06-0.09 of length) and with a small to medium size lobe on each side of midline, short to moderately long setae on apical 0.71-0.98 of sternum, setae 1-3-S widely separated, located in a more or less diagonal line, 1-S basomesad of 2-S and 3-S apico-laterad of 2-S, apical intersegmental fold lightly pigmented, VIII-S index 0.54-0.98, length 0.17-0.32 mm, width 0.30-0.43 mm; tergum IX covered with minute spicules, moderately pigmented, apex with a small median indentation or straight and with 1-7 setae on each side of midline, 3-12 total setae, IX-Te index 0.56-0.98, length 0.06-0.12 mm, width 0.10-0.15 mm; insula covered with minute spicules, moderately pigmented, long, tongue-like, with 2-7 small tuberculi each with a minute spicule, tuberculi located about 0.5 from base; lower vaginal lip with numerous minute to long spicules scattered over surface, moderately pigmented, narrow, lower vaginal sclerite absent; upper vaginal lip with short spicules, heavily pigmented, narrow, upper vaginal sclerite well developed, moderately to heavily pigmented, medium to large size; postgenital lobe covered with short spicules, moderately long, moderately broad, apex with a very small to moderately deep median indentation (0.03-0.25 of length), with 4-13 setae on each side of midline, 9-26 total setae, dorsal PGL index 0.85-1.09, ventral PGL index 1.20-1.73, ventral

length 0.09-0.15 mm; perianal membrane with scattered short spicules over entire surface; cercus covered with short spicules, moderately long, apex sharply rounded with 2, 3 long stout setae, dorsal surface with a number of short to moderately long setae on apical 0.70-0.91, scales usually absent (0-5 scales in *bonneae*, *chrysoscuta* and *ostentatio*, and 1-8 in *menoni*), ventral surface with a few short setae on lateral margin, cercus index 2.15-3.48, cercus/dorsal PGL index 2.41-3.71, cercus length 0.15-0.27 mm; one large seminal capsule (one large and 2 medium size ones in *menoni*), heavily pigmented, spherical, several small seminal capsule pores near orifice, base of accessory gland duct moderately to heavily pigmented.

**PUPA.** *Cephalothorax.* Ocular plate with cuticular facets poorly developed; setae 1-3-CT moderately long, subequal in length, multiple branched; 9-CT longer than 8-CT. *Respiratory trumpet.* Index 3.21-6.31. *Metanotal plate.* Seta 11-CT single, occasionally barbed, longer than 10, 12-CT; 10, 12-CT multiple branched. *Abdomen.* Setae 1-II, III multiple branched, 1-II with 5-22 branches; 2-II moderately long to long, stout and only slightly shorter than 3-II; 4-VIII single (rarely 2, 3 branched), noticeably longer than 3-VIII; 5-IV-VI long, single (occasionally 2 branched in *collessi*); 9-VIII moderately long to long, single (rarely 2 branched in *bonneae*). *Paddle.* Without fringe of hair-like spicules; index 1.01-2.22; seta 1-P moderately long to long, single. A summary of ranges of setal branching for known species (*bonneae*, *chrysoscuta*, *collessi*, *ostentatio* and *thailandensis*) follows. *Cephalothorax.* Seta 1-CT with 2-7 branches; 2, 3, 7-CT with 2-5 branches; 4-CT single to 7 branched; 5-CT single to 8 branched; 6-CT single; 8-CT with 2-10 branches; 9-CT single to 6 branched. *Metanotal plate.* Setae 10, 12-CT with 2-8 branches; 11-CT single and occasionally barbed. *Abdomen.* Seta 1-I with 15-53 branches in basal 0.33; 2, 6-I single or 2 branched; 3-I single to 3 branched; 4-I with 4-10 branches; 5-I with 2-6 branches; 7-I single to 5 branched; 9, 10-I single; 0, 3-II single (occasionally 2 branched in *thailandensis*); 1-II with 5-23 branches; 2, 6, 9-II single or 2 branched; 4-II with 3-11 branches; 5-II with 2-9 branches; 7-II single to 6 branched; 0, 2, 3, 9, 11, 14-III single; 1-III with 2-10 branches; 4-III single to 5 branched; 5-III with 2-11 branches; 6-III single to 8 branched; 7, 10-III single to 5 branched; 8-III with 2-6 branches; 0, 2, 9, 11, 14-IV single; 1-IV single to 9 branched; 3-IV single to 8 branched; 4, 7, 8-IV single to 4 branched; 5-IV single or 2 branched; 6-IV single to 6 branched; 7-IV single to 3 branched; 10-IV single to 5 branched; 0, 2, 5, 9, 11, 14-V single; 1, 6-V single to 6 branched; 3-V single to 4 branched; 4-V with 2-7 branches; 7-V single to 8 branched; 8-V with 2-5 branches; 0, 2, 9, 11, 14-VI single; 1, 4, 6-VI single to 6 branched; 3-VI single to 3 branched; 5, 7, 10-VI single or 2 branched; 8-VI single to 5 branched; 0, 2, 7, 11, 14-VII single; 1, 4, 10-VII single to 4 branched; 3-VIII single to 5 branched; 5-VII single or 2 branched; 6-VII single to 7 branched; 8-VII single to 6 branched; 9-VII single to 3 branched; 0-VIII single; 4, 14-VIII single to 3 branched. *Paddle.* Seta 1-P single.

**LARVA.** *Head.* Moderately to heavily pigmented; seta 1-C long, stout; 4-C multiple branched, short, mesad and slightly to moderately caudad of 5-C; 5, 6-C multiple branched, long to very long, stout, barbed; 6-C laterad and slightly cephalad of 5-C; insertions of 4-C and 6-C each approximately equal distance from 5-C; 7-C multiple branched, long, stout, barbed, caudomesad of base of antenna; 8-10, 12-C short; 13-C multiple branched, moderately long, occasionally barbed; dorsomentum with 26-34 teeth; ventromedian cervical sclerite moderately pigmented. *Antenna.* Scape moderately long to long, numerous short spicules scattered along entire length, moderately pigmented,

index 9.84-16.90; seta 1-A multiple branched, moderately long, stout, barbed, inserted 0.45-0.61 from base; 2-6-A inserted at or near apex. *Thorax*. Seta 8-P single (2 branched in 2 specimens of *chrysoscuta*), long, stout, barbed. *Abdomen*. Seta 6-I-V long, stout, barbed; comb on VIII with 7-18 scales in a single curved row, each scale with a median apical spine and basally with short denticles along lateral margins; 4-VIII longer (usually noticeably longer) than 3-VIII; 1-X short; 2-X multiple branched, moderately long; 3-X very long; saddle moderately pigmented, incompletely rings segment X, acus absent; 4 anal papillae, moderately long. *Siphon*. Pigmentation variable; acus well developed; index 1.77-4.20; pecten on basal 0.42-0.66 of siphon, with 11-24 teeth, distal one to 3 teeth more widely spaced than remainder; 1-S short, inserted in basal 0.57-0.69 of siphon distad of last pecten tooth, 2-S inserted in or near caudal margin of siphon. A summary of ranges of setal branching for known species (*bonneae*, *chrysoscuta*, *collessi*, *ostentatio* and *thailandensis*) follows. *Head*. Setae 0, 1, 3, 14, 18, 20-C single; 4-C with 5-13 branches; 5-C with 3-8 branches; 6, 10-C with 2-6 branches; 7-C with 5-14 branches; 8-C single to 8 branched; 9-C with 2-5 branches; 11-C with 2-8 branches; 12-C with 3-11 branches; 13-C with 4-9 branches; 15-C with 2-5 branches. *Antenna*. Seta 1-A with 3-6 branches. *Thorax*. Seta 0-P with 7-20 branches; 1-P single to 4 branched; 2, 9-P single to 3 branched; 3-P with 2-6 branches; 4, 11-P single to 6 branched; 5, 6, 10, 12-P single; 7-P with 2-4 branches; 8-P single or 2 branched; 14-P with 2, 3 branches; 1-M with 2-5 branches; 2-M single to 5 branched; 3-M single to 3 branched; 4-M with 2-7 branches; 5, 7, 10, 12-M single; 6-M with 3-7 branches; 8-M with 4-9 branches; 9-M with 4-8 branches; 11-M single or 2 branched; 13-M with 9-27 branches; 14-M with 5-20 branches; 1-T single to 4 branched; 2-T single to 6 branched; 3-T with 5-17 branches; 4-T with 2-6 branches; 5, 10-T single; 6, 11-T single to 3 branched; 7-T with 4-12 branches; 8-T with 3-14 branches; 9-T with 2-4 branches; 12-T single or 2 branched; 13-T with 7-20 branches. *Abdomen*. Setae 0, 14-VIII single; 1-VIII with 3-7 branches; 2-VIII single to 4 branched; 3-VIII with 3-13 branches; 4-VIII single to 3 branched; 5-VIII with 3-10 branches; 1-X single to 3 branched; 2-X with 4-13 branches; 3-X single; 4-X with 8-10 setae on grid, each with 2-16 branches (some setae of each specimen always with 8 or more branches), and usually one short precratal seta. *Siphon*. Seta 1-S with 2-6 branches; 2, 6, 7, 9-S single; 8-S single to 4 branched.

#### EGG. Not known.

**MEDICAL IMPORTANCE.** Females of several species (*collessi*, *ostentatio* and *thailandensis*) have been collected feeding on man. Leicester (1908: 194) reports that *ostentatio* is a vicious biter during the day. Even though the females of several species feed on man, few investigations have been conducted for pathogen isolation from members of this subgenus. Four specimens of *ostentatio* from The Philippines were dissected and found to be negative for *Brugia malayi* (Brug) parasites (Rozeboom and Cabrera 1965: 208). Ramachandran et al. (1970: 511) examined 10 specimens of *ostentatio* collected from Trengganu, Malaysia, and found they were negative for *Brugia malayi* and non-filarial nematodes. Small numbers of specimens of both *collessi* and *ostentatio* from Malaysia were dissected and found negative for filaria parasites (Ann. Rep. Inst. Med. Res. for 1963-1965, 1968, Fed. Malaya and Malaysia, 1968: 63, 89, 1968: 27, 1968: 23, 32, 1968: 112).

**DISTRIBUTION.** The subgenus *Paraedes* occurs throughout most of the Oriental region. Species of the subgenus have been collected from India, Indonesia, Malaysia, The Philippines, Sri Lanka, Thailand and Vietnam.

**DISCUSSION.** The subgenus *Paraedes* is characterized and distinguished from the other subgenera of *Aedes* by the following: in the adults by the combination of (1) numerous anterior and posterior dorsocentral setae; (2) acrostichal setae usually absent (3, 4 in male of *barraudi*, 0-3 in female of *collessi* and 2-4 in female of *thailandensis*); (3) lower mesepimeral seta absent; (4) prescutellar bare space without scales; (5) paratergite usually bare (scaled in *thailandensis* and female of *pagei*); and (6) male palpus short, less than 0.12 length of proboscis; in the male genitalia by the combination of (1) aedeagus with 2 approximated lateral plates each with up to 3 lateral teeth; (2) basal mesal lobe with 2 arms, one arm long, narrow, curved and with 3 stout apical setae, other arm broader, with 3-5 flattened apical setae or with long narrow spines; and (3) gonostylus moderately long, bifid or trifid, one or 2 arms with spicules forming file-like ridges, one arm with short fine setae, spiniform absent; in the female genitalia by the combination of (1) only a single large seminal capsule (one large and 2 medium size ones in *menoni*); (2) insula tongue-like, with 2-7 small tuberculi each with a minute spicule, tuberculi located approximately 0.5 from base; (3) upper vaginal sclerite well developed, narrow; (4) tergum VIII and sternum VIII usually without scales; and (5) cercus moderately long, index 2.15-3.48, usually without scales; in the pupa by the combination of (1) seta 9-CT longer than 8-CT; (2) seta 1-II with 5-22 branches; (3) seta 9-VIII moderately long to long, single (2 branched in 2 specimens of *bonneae*); (4) seta 1-P moderately long to long, single; (5) paddle shape (see figures) and without a fringe of hair-like spicules; and (6) seta 2-II moderately long to long, stout and only slightly shorter than 3-II; and in the larva by the combination of (1) position and development of head setae 4-7-C; (2) antennal scape spiculate, seta 1-A moderately long, stout, multiple branched; (3) 6-I-V long, stout, barbed; (4) 4-VIII single (rarely 2 or 3 branched in *chrysoscuta*), noticeably longer than 3-VIII; (5) comb on VIII with 7-18 scales, in a single curved row, each scale with a median apical spine; (6) segment X with saddle incomplete, acus absent, 2-X moderately long and multiple branched, 3-X very long and single; and (7) pecten with distal one to 3 teeth more widely spaced than basal teeth.

The short maxillary palpi of the males of *Paraedes* are similar to those of the following subgenera of *Aedes*: *Aedes*, *Bothaella* Reinert, *Cancraedes* Edwards, *Christophersiomyia* Barraud, *Huaedes* Huang, *Leptosomatomyia* Theobald, *Nothoskusea* Dumbleton, *Rhinoskusea* Edwards, *Verrallina* Theobald and most species of *Geoskusea* Edwards.

The absence or reduction of the setae on the margin of the upper calypter of the male wing is similar to the reduced number found in the males of the subgenus *Cancraedes*, members of the subgenus *Rhinoskusea*, and the genus *Udaya*.

Male genitalia of *Paraedes* are unique and easily separated from those of other subgenera of *Aedes* by the development of the basal mesal lobe, gonostylus and phallosome. Species of the subgenus *Paraedes*, however, show some resemblance in the male genitalia to those of the subgenus *Aedes*, but they can be segregated by the above features. Reinert (1976a: 4) pointed out the similarity of the file-like ridges on the gonostylus between *Paraedes* and the subgenus *Indusius* Edwards.

The female genitalia of *Paraedes* are most similar to those of the subgenus *Aedes*. Differences between the 2 subgenera are: *Paraedes* has the insula with small tuberculi near middle of length, tergum VIII without scales, one large seminal capsule (*menoni* with one large and 2 smaller ones), and tergum IX with one to 7 setae on each lobe; while *Aedes* has the insula with

small tuberculi on apical 0.5, tergum VIII with a number of scales, one large and 2 smaller seminal capsules, and tergum IX with 12 or more setae on each lobe. Other subgenera of *Aedes* with a single large seminal capsule are *Cancraedes*, *Rhinoskusea*, Niveus Group of *Finlaya* Theobald and several species of *Aedimorphus*. These subgenera are easily distinguished from *Paraedes* by: *Cancraedes* and *Aedimorphus* have different shaped cerci and terga VIII and IX, and the tuberculi are located on apical 0.3 of the insula, and *Rhinoskusea* and *Finlaya* have a lip-like insula with long setae and the upper vaginal sclerite is absent.

Larvae of the species of *Paraedes* are uniform in external morphology and difficult to separate with the exception of *thailandensis*, which has several unique characters. *Paraedes* larvae are very similar morphologically to those of the subgenus *Aedes* and *Ae.* (*Neomelaniconion*) *lineatopennis* (Ludlow). The following features are distinctive for each. *Paraedes* larvae have: seta 4-C inserted caudad of 5-C; 5, 6-C very long; 13-C usually 6-8 (4-9) branched; 4-VIII noticeably longer than 3-VIII; siphon without accessory setae; and crab holes as their usual immature habitat; *Aedes* larvae have: seta 4-C inserted cephalad of 5-C; 5, 6-C long; 13-C usually 2-4 (2-5) branched; 4-VIII shorter than or approximately equal to length of 3-VIII; siphon with accessory setae inserted usually subdorsally and/or subapically; and fresh water ground pools as their immature habitat; and *Ae.* (*Neo.*) *lineatopennis* larvae possess the features listed for the subgenus *Aedes* except for the accessory setae of the siphon which are absent and 4-VIII longer than 3-VIII. The latter species also has setae 1, 2-VIII inserted on a common sclerotized plate, and the saddle nearly encircles segment X.

The subgenus *Paraedes* appears to be most similar morphologically to the subgenus *Aedes* as noted above in the characters of the adult, male genitalia, female genitalia and larva. These 2 subgenera, however, can be separated by the features previously outlined. These 2 subgenera also have allopatric distributions.

**BIONOMICS.** Adults of most species of *Paraedes* have been collected feeding on man, and at times they have been reported as vicious biters. Biting activity has occurred in partially and heavily shaded areas of forests, bamboo groves and coastal villages. Some species have been taken in light and Malaise traps. *Aedes collessi* has been collected from human, monkey, *Berok* and calf baited traps.

The usual immature habitat is fresh water in small and large crab holes; however, they have also been collected from water in a small deep hole near a stream, elephant footprints, nipah palm fronds, ground pools among nipah palm trees, a small pool in a jungle, and a small wheel track. These habitats were located in valleys and in hilly and mountainous terrain, in partially or heavily shaded areas of secondary rain forests, secondary scrub, bamboo groves and a tapioca plantation.

## KEYS TO SPECIES OF *AEDES* (*PARAEDES*)

## FEMALES

- 2(1). Antepronotum with only narrow curved scales. . . . . 3  
 Antepronotum with broad scales (may also have narrow curved scales. . . . . 5
- 3(2). Posttarsi I-III with toothed unguis. . . . . *pagei*  
 Posttarsi I-III with simple unguis. . . . . 4
- 4(3). Genitalia with a single large seminal capsule; antepronotum with only dark scales. . . . . *collessi*  
 Genitalia with one large and 2 medium size seminal capsules; antepronotum with both dark and pale scales. . . . . *menoni*
- 5(2). Paratergite with narrow pale scales; antepronotum with both narrow curved and broad pale scales; sternum VIII index 0.86-0.96.  
*thailandensis*  
 Paratergite without scales; antepronotum with only broad dark and/or pale scales; sternum VIII index 0.59-0.73. . . . . 6
- 6(5). Pleural integument and antennal pedicel pale golden-brown; posttarsus III with toothed unguis. . . . . *chrysoscuta*  
 Pleural integument and antennal pedicel dark brown; posttarsus III with simple unguis. . . . . *ostentatio*

## MALE GENITALIA

1. Gonostylus trifid. . . . . *bonneae*  
 Gonostylus bifid. . . . . 2
- 2(1). Basal mesal lobe with one arm bearing 3-5 flattened apical setae. . . 3  
 Basal mesal lobe with one arm bearing long thin spines. . . . . 6
- 3(2). Basal mesal lobe with one arm bearing 3 flattened apical setae.  
*collessi*  
 Basal mesal lobe with one arm bearing 4 or 5 flattened apical setae. . . . . 4
- 4(3). Basal mesal lobe with one arm bearing 5 flattened apical setae.  
*thailandensis*  
 Basal mesal lobe with one arm bearing 4 flattened apical setae. . . . . 5
- 5(4). Gonostylus bifid with longer arm greatly expanded and with 6-8 short setae on sternal surface. . . . . *barraudi*  
 Gonostylus bifid with longer arm only slightly expanded and with 3, 4 short setae. . . . . *menoni*
- 6(2). Gonocoxite with a subapical patch of 35-45 setae on sternal surface; basal mesal lobe with one arm gently tapered from base to a pointed apex and with long dendritic spines on apical 0.4. . . *chrysoscuta*  
 Gonocoxite with a subapical patch of 20-25 setae on sternal surface; basal mesal lobe with one arm swollen near middle and with short simple spines near middle and on apical 0.25. . . . . *ostentatio*

## PUPAE



#### FOURTH STAGE LARVAE



## SPECIES TREATMENT

*AEDES (PARAEDES) BARRAUDI (EDWARDS)*

(Figs. 1, 3, 27)

*Paraëdes barraudi* Edwards, in Barraud 1934: 447 ( $\sigma^*$ ).

*Aëdes (Paraëdes) barraudi* of Mattingly 1958a: 24 (key), 1958b: 78 ( $\sigma^*$ ), 1958c: 106 (lectotype designation).

*Aedes (Paraeides) barraudi* of Stone, Knight and Starcke 1959: 199; Stone and Delfinado 1973: 306; Knight and Stone 1977: 148.

**MALE** (Fig. 1). *Head.* Antenna dark brown, 0.89-0.94 length of proboscis, pedicel dark brown with a few small brown scales and with short fine

brown setae mesally; maxillary palpus 0.11 length of proboscis; clypeus dark brown; proboscis 1.01-1.10 length of femur I; vertex covered with broad decumbent dark brown scales, a few narrow curved white scales on interocular space, ocular line with small narrow curved white scales; lateral surface covered with broad dark brown scales and with a small patch of broad white scales anterior to antepronotum and posterior to eye margin; occiput with narrow curved decumbent white scales and a few moderately long erect forked golden-white and brown scales; interocular and ocular setae dark brown and well developed; eyes contiguous anteriorly, but slightly separated dorsally.

**Thorax.** Scutal integument reddish-brown; scutum covered with narrow curved reddish-brown scales except for narrow curved white scales on following areas: a small patch on anterior promontory area, a small patch on scutal fossal areas extending anteriorly onto lateral area above postpronotum, a small patch at scutal angle and a few similar scales along posterior margin of scutal ridge, a small patch on posterior scutal fossal area, a small patch on supraalar area anterior to base of wing, a short narrow stripe on anterior portion of posterior dorsocentral area, a small patch on posterolateral margin of prescutellar space and 3 small indistinct patches on anterior dorsocentral and acrostichal areas each of 3, 4 scales; scutum with reddish-brown setae as follows: 2 anterior promontory, 3, 4 anterior acrostichal, numerous dorsocentral (anterior and posterior), scutal fossal (3, 4 anterior, 1, 2 lateral, and 1, 2 posterior), 30-36 supraalar, 3, 4 posterior medial scutal; scutellum with a patch of narrow curved white scales on each lobe, 4, 5 long and 1, 2 short setae on median lobe, 3 long and 1-3 short setae on lateral lobe; pleural integument dark brown; antepronotum with broad white scales, 7-9 brown setae; postpronotum with a few narrow curved reddish-brown scales dorsally and a small patch of 10-12 moderately broad curved pale scales on posterior area anterior to setae, 4, 5 brown posterior setae; postspiracular area with a few broad white scales, 3, 4 golden setae; propleuron with a patch of broad white scales, 4, 5 golden-brown setae; paratergite bare; mesepisternum with an upper and a lower posterior patch of broad white scales, 8-13 golden setae on upper and posterior areas, lower setae shorter and white; prealar knob with 5, 6 golden setae; mesepimeron with a patch of broad white scales, 9, 10 pale golden setae dorsad of scales; other pleural areas bare. **Legs.** Coxae I-III with several brown or golden setae, I with anterior surface with broad brown scales and a dorsal and a ventral patch of white scales, II and III with a patch of broad white scales on anterior surface; trochanters I-III with white scales and a few short setae; femora I and II with anterior surface brown scaled, III with a broad ventral longitudinal stripe of broad white scales from base to near apex on both anterior and posterior surfaces, a similar stripe on posterior surface of II, I with a broad dorsal longitudinal white scaled stripe from base to near apex of posterior surface, I-III with a small dorsoapical white scaled patch; posttarsi I-III (Fig. 27) with 2 unguis, I and II with unguis equal in size and with a tooth, III with unguis equal in size, both simple. **Wing.** Dorsal and ventral veins brown scaled; costa with a small white scaled patch on base of anterior surface; alula with narrow pale brown scales along margin; 1, 2 golden remigial setae; upper calypter bare. **Halter.** Pedicel pale; capitellum white scaled with a few pale brown scales at base. **Abdomen.** Terga II-VI dark brown scaled with a laterobasal white scaled patch (remainder of abdomen removed with genitalia); sterna brown scaled; terga and sterna with numerous short golden setae, mostly along posterior margins. **Genitalia** (Fig. 3). Tergum IX moderately to heavily pigmented, strongly bilobed, with 7, 8 short setae on each lobe; gonocoxite moderately pigmented, tergal surface with 5-7 long stout

and 11-13 short to moderately long setae scattered over surface and with a short double row of short setae on basal 0.2 of mesal margin, lateral surface with several moderately long setae, sternal surface with 6-9 long stout setae on lateroapical 0.25 and a number of short setae scattered over remainder of area, a subapical circular patch of 49-54 short and moderately long setae on mesal margin, lateral surface and lateral portions of tergal and sternal surfaces with scales; gonostylus approximately 0.71 length of gonocoxite, pedicel short, broad and 0.3 of overall length, distal 0.7 bifid and divided into a long narrow mesally curved arm with short ridges of spicules on mesal surface, inserted 0.3 from base of gonostylus, and a mesal longer flattened arm with apical portion with spicules forming file-like ridges, a row of 6-8 short setae and several short thin setae on sternal surface, several minute setae in a row on tergal surface; basal mesal lobe divided at base into 2 long arms, sternomesal arm cylindrical with a slight bend near middle and with 3 moderately long hook-like setae at apex, outer arm somewhat flattened and forked in distal 0.36 into an outer extension with 4 short stout setae and a similarly shaped bare mesal extension, also a ventral sclerotized structure near 0.4 from base of arm; phallosome with aedeagus divided into 2 pigmented narrow lateral plates connected basally, apical 0.3 with a lightly pigmented sternal connection, distal portion of each plate bluntly rounded with apex pointed and projected mesally, paramere approximately 0.88 length of lateral plate, parameral apodeme long and narrow; sternum IX large, with 2 long stout setae near center.

FEMALE, PUPA and LARVA. Not known.

TYPE-DATA. The lectotype male of *barraudi*, deposited in the British Museum (Natural History) (BMNH), possesses the following data on the adult labels: Coorg, Virajpet, S. India, VI. 1927, J. D. Baily [collector]; 2673 [collection number]; *Paraëdes barraudi* Edwards, HOLOLECTOTYPE, P. F. Mattingly, 14: ii: 58; Type [circular label with a red border]; and SEAMP Acc. No. 295. The lectotype is in good condition and the genitalia are mounted in balsam. A single male paratype has the same label data as the lectotype except for the collection number, 2672, and a paratype label [circular label with a yellow border]. The paratype is in fair condition and the genitalia are mounted in balsam on a small cover glass on a card attached to the pin. *Aedes barraudi* is still known only from the 2 males which Edwards (*in Barraud 1934: 447*) designated as cotypes. Mattingly (1958c: 106) selected a lectotype from the cotypes.

DISTRIBUTION. Two specimens examined: 2♂.

INDIA. Virajpet, Coorg, June 1927, J. D. Baily, 2673 (lectotype), 1♂, 2672 (paratype), 1♂.

*Distribution from literature.*

INDIA. Virajpet, Coorg, South India (Edwards *in Barraud 1934: 447*; Mattingly 1958c: 106).

DISCUSSION. The adult habitus of *barraudi* is distinctive in that the scale pattern of the scutum (Fig. 1) easily separates this species from the others of the subgenus. The presence of 3, 4 anterior acrostichal setae in the male of *barraudi* differs from the males of other species of the subgenus which have these setae absent. However, females of *collessi* and *thailandensis* have 0-3 and 2-4 anterior acrostichal setae, respectively.

Male genitalia of *barraudi* are most similar to those of *collessi* especially in the development of the gonostylus. Features of the basal mesal lobe, gonocoxite and tergum IX (Figs. 3, 6) are distinctive for these 2 species.

BIONOMICS. Edwards, *in Barraud (1934: 447)*, states that the type was

collected in June.

**AEDES (PARAEDES) BONNEAE MATTINGLY**

(Figs. 2, 4, 10, 17, 22, 23, 27, 28)

*Aëdes (Paraëdes) bonneae* Mattingly 1958a: 8, 11, 13, 21, 22, 24, 25, 27, 30, 32, 34, (♀\*, ♂\*, P\*, L\*, keys).

*Aedes (Paraedes) bonneae* of Stone, Knight and Starcke 1959: 199; Stone and Delfinado 1973: 306; Knight and Stone 1977: 148.

**MALE.** Head. Antenna dark brown, 1.15-1.29 length of proboscis, pedicel dark brown with a few short fine setae mesally; maxillary palpus 0.11-0.12 length of proboscis; clypeus dark brown; proboscis 1.02-1.10 length of femur I; vertex completely covered with broad decumbent dark brown scales; lateral surface with broad dark brown scales and with a small patch of broad pale scales anterior to antepronotum and posterior to eye margin; occiput with a few short erect forked dark brown scales; interocular and ocular setae dark brown and well developed; eyes contiguous anteriorly. Thorax. Scutal integument dark brown; scutum covered with narrow curved dark reddish-brown scales; scutum with dark setae as follows: 2 anterior promontory, numerous dorsocentral (anterior and posterior), scutal fossal (3-5 anterior, 2-5 lateral and 1 posterior), numerous supraalar, 4 posterior medial scutal; scutellum with a patch of broad scales on each lobe, 6, 7 setae on median lobe and 4 setae on lateral lobe; pleural integument dark brown; antepronotum with a patch of broad dark brown scales on posterior surface and a few narrow dark brown scales on anterior area, 5-7 dark setae; postpronotum with narrow curved dark reddish-brown scales, 3 dark posterior setae; propleuron with a patch of broad silvery-white scales, 5, 6 dark or golden setae; paratergite bare; postspiracular area with a few broad translucent white scales posterior of setae (scales rubbed off in some specimens), 3 dark setae; mesepisternum with a large patch of broad silvery-white scales on upper area and a small patch of similar scales on lower area, 2, 3 dark setae on upper area and 7-9 setae on posterior area, lower setae short and pale; prealar knob with 4-6 dark setae; mesepimeron with a large patch of broad silvery-white scales, 10-12 short dark setae dorsad of scales. Legs. Coxae I-III with several setae, I with anterior surface with broad brown scales and with a small patch of silvery-white scales dorsally, II and III with a small patch of broad silvery-white scales on anterior surface; trochanters I-III pale scaled and with a few short setae; femora I-III with anterior surface brown scaled, II and III with posterior surface brown with a ventrobasal pale scaled area; posttarsi I-III (Fig. 27) with 2 unguis, I and II with unguis equal in size and with a tooth, III with unguis equal in size, both simple. Wing. Dorsal and ventral veins with dark brown scales; costa without a patch of white scales; alula with moderately broad dark brown scales on margin and a second row of moderately broad to broad scales parallel to margin; 1, 2 dark remigial setae; upper calypter with a number of narrow dark setae on margin. Halter. Pedicel pale; capitellum covered with broad dark brown scales. Abdomen. Terga II-VII dark brown scaled and with a small patch of pale scales on laterobasal area; sterna dark brown scaled with a few pale scales on basal areas; terga with a few short setae on lateral and posterior margins. Genitalia (Fig. 4). Tergum IX heavily pigmented, bilobed, with 3-5 short stout setae on each lobe, cephalic margin emarginate, lateral margin narrowly connected to

sternum IX; gonocoxite heavily pigmented, tergal surface with 5-7 moderately long and long stout setae on mediolateral area, 2 moderately long setae on mesal margin approximately 0.3 from base, sternal surface with several very long stout setae on apical 0.4, mesal margin with a widely spaced row of stout setae, apical setae very long and basal setae short, lateral and sternal surfaces with numerous broad scales, tergal, sternal and lateral surfaces covered with minute spicules; gonostylus approximately 1.07 length of gonocoxite, trifid, outer arm long, narrow, with apex pointed and slightly curved, 6, 7 short setae along length, inner arm with a sharp bend at approximately 0.22 from base, long, narrow, apical 0.25 curved outward, apex with a small patch of spiculate rows, third arm arising from inner arm near basal bend, arm long, very narrow and with apex expanded into a hemispherical club bearing 12, 13 short setae; basal mesal lobe divided at base into 2 long caudally projecting arms, dorsomesal arm narrow at base and expanding into a broad apical area that is covered with moderately long spicules, 3 moderately long, broad, flat setae at approximately 0.32 from apex, ventral arm long, narrow, covered with minute spicules, apical area with 3 long curved setae; phallosome with aedeagus divided into 2 heavily pigmented lateral plates that are connected basally, each plate curved tergomesad and with 1, 2 long basomesal teeth, a lightly pigmented dorsal flap covering lateral plates, paramere approximately 0.86 length of aedeagus, parameral apodeme moderately broad, approximately 1.65 length of paramere; sternum IX moderately to heavily pigmented, apical margin rounded, 2 long stout setae on caudomesal area.

**FEMALE.** Essentially as in male but with the following differences. *Head.* Antenna 1.17-1.26 length of proboscis, pedicel also with a few small dark scales mesally; maxillary palpus 0.18-0.19 length of proboscis; proboscis 1.02-1.07 length of femur I; vertex also with a few narrow pale scales on coronal suture; lateral surface with pale scaled patch larger; occiput with a few narrow pale scales in some specimens. *Thorax* (Fig. 2). Scaling as in male but also with a few narrow curved pale scales on anterior promontory area, anterior scutal fossal area, and a few on acrostichal area; scutellum with a few broad pale scales basad of dark brown scales of median lobe, 8-11 dark setae on median lobe and 6-8 setae on lateral lobe; antepronotum with narrow curved dark brown scales on posterior surface and a few broad brown scales on anterior area (some specimens with broad scales rubbed off), 7-9 dark setae; postpronotum with 3, 4 posterior dark setae; propleuron with 6-8 setae; postspiracular area with 3, 4 setae; mesepisternum with 3, 4 upper and 10-14 posterior setae; prealar knob with 7-9 dark setae; mesepimeron with 15-18 setae dorsad of scale patch. *Legs.* Posttarsi I-III (Fig. 28) with 2 unguis, I and II with unguis equal in size and with a tooth, III with unguis equal in size, both simple. *Abdomen.* Terga with medium size laterobasal pale scaled patches. *Genitalia* (Fig. 10). Tergum VIII moderately pigmented, scales absent, basal 0.75-0.90 retracted into segment VII, base concave mesally, apex straight, several short setae scattered over apical 0.46-0.61, setae along apex short and thin with the exception of 2, 3 moderately long thin ones, basolateral seta absent, VIII-Te index 0.56-0.57, VIII-Te/IX-Te index 2.54-2.65, length 0.17-0.19 mm, width 0.28-0.32 mm; sternum VIII moderately pigmented, scales absent, base concave mesally, apex with a small median indentation (0.06-0.08 of length) and with a very small lobe on each side of midline, short to moderately long setae on apical 0.71-0.79, seta 2-S approximately 0.58 from 1-S, seta 3-S approximately 0.42 from 2-S, apical intersegmental fold lightly pigmented, VIII-S index 0.54-0.60, length 0.17-0.20 mm, width 0.30-0.32 mm; tergum IX moderately pigmented, apex nearly

straight, base with a small median indentation, 1, 2 setae on each side of midline at apex, 3, 4 total setae, IX-Te index 0.56-0.63, length 0.06-0.07 mm, width 0.11 mm; insula with 4, 5 small tuberculi; lower vaginal lip with numerous minute spicules scattered over entire surface, lower vaginal sclerite absent; upper vaginal lip heavily pigmented, narrow, upper vaginal sclerite moderately pigmented, large size; postgenital lobe with a moderately deep median indentation (0.11-0.17 of length) apically, 6-9 (usually 8) setae on each side of midline, 15, 16 total setae, dorsal PGL index 0.88-0.96, ventral PGL index 1.46-1.70, ventral length 0.09-0.10 mm; cercus with 2, 3 long stout setae apically, dorsal surface with a number of short to moderately long setae on apical 0.84-0.88, 2-4 broad scales, ventral surface with a few short setae on lateral margin, cercus index 2.41-2.58, cercus/dorsal PGL index 3.04-3.13, cercus length 0.16-0.19 mm; one large seminal capsule, base of accessory gland duct heavily pigmented.

**PUPA** (Figs. 17, 22). Chaetotaxy as figured and recorded (Table 1). *Cephalothorax*. Seta 1-CT with 3-5 branches. *Respiratory trumpet*. Index 3.73-5.25, mean 4.53. *Abdomen*. Seta 1-II with 14-22 branches; 2-II inserted laterad of 3-II; 1-III with 4-10 branches; 1-IV with 4-9 branches; 1-V with 3-6 branches; 6-VI single. *Paddle*. With minute spicules on apical 0.31-0.46 of lateral and apical 0.08-0.16 of mesal margins; index 1.39-2.03, mean 1.86.

**LARVA** (Fig. 23). Description based on 10 larval exuviae with associated adults. *Head*. Moderately to heavily pigmented; setae 0, 1, 3, 14, 18, 20-C single; 4-C with 6-11 (8) branches; 5-C with 5-7(5) branches; 6-C with 4-6 (5) branches; 7-C with 9-14 (10) branches; 8-C with 2, 3 (2) branches; 9-C with 2, 3 (3) branches; 10-C with 2-4 (2) branches; 11-C with 4-7 (4) branches; 12-C with 3-10 (5) branches; 13-C with 4-9 (6) branches; 15-C with 2-4 (3) branches; dorsomentum with 29-33 (usually 32) teeth, heavily pigmented. *Antenna*. Scape moderately long, index 9.84-10.97, mean 10.58; seta 1-A with 3-6 (4) branches, inserted 0.52-0.55 from base. *Thorax*. Seta 0-P with 7-14 (8) branches; 1, 9-P single or 2 (1) branched; 2-P with 2 branches; 3-P with 2-4 (3) branches; 4, 11-P single to 3 (2) branched; 5, 6, 8, 10, 12-P single; 7-P with 2, 3 (3) branches; 14-P with 2, 3 (2) branches; 1-M with 2-4 (3) branches; 2-M single to 3(2) branched; 3, 5, 7, 10, 12-M single; 4-M with 3, 4 (3) branches; 6-M with 4-6 (6) branches; 8-M with 5-8 (6) branches; 9-M with 5-7 (7) branches; 11-M single or 2 (1) branched; 13-M with 9-17 (12) branches; 14-M with 10, 11 branches; 1, 6-T single to 3 (2) branched; 2-T with 3, 4 (3) branches; 3-T with 6-10 (9) branches; 4-T with 2-5 (3) branches; 5, 10-T single; 7-T with 5-9 (8) branches; 8-T with 5, 6 (6) branches; 9-T with 3, 4 (3) branches; 11, 12-T single or 2 (1) branched; 13-T with 7, 8 (8) branches. *Abdomen*. Setae 0, 14-VIII single; 1-VIII with 3, 4 (3) branches; 2-VIII single to 3(2) branched; 3-VIII with 3-7 (5) branches; 4-VIII single or 2 (1) branched; 5-VIII with 4-7 (6) branches; comb on VIII with 11-16 (usually 12-14) scales; 1-X single or 2 (2) branched; 2-X with 6-10 (7) branches; 3-X single; ventral brush with 10 setae on grid, each with 2-13 branches, some setae always with 10 or more branches, anterior setae shorter and with fewer branches than posterior ones. *Siphon*. Moderately pigmented with apical 0.4 more heavily pigmented than basal 0.4; index 2.67-3.92, mean 3.17; pecten on basal 0.45-0.51, with 11-15 (usually 12, 13) teeth, each tooth with one or 2 small ventral denticles near base, apex of teeth long, narrow and pointed, distal 1, 2 teeth spine-like, without denticles and wider spaced than remainder; 1-S with 2-4 (2) branches, inserted on basal 0.60-0.64 of siphon distad of last pecten tooth; 2-S single, short; 6, 7, 9-S single; 8-S single or 2 (2) branched.

**TYPE-DATA.** The holotype male, deposited in the BMNH, possesses the

following data on the adult labels: SELANGOR, Rantau Panjang, 4.3. 1953, J. A. Reid [on upper surface of label], Ex. Coll. I.M.R. Malaya [on under surface of label]; 598/4 [collection number]; *A. (Skusea) near curtipes* Det. J. A. Reid; *Aë. (Paraëdes) bonneae* Mattingly, HOLOTYPE, P. F. Mattingly, 20: viii: 1957; and TYPE [circular label with a red border]. The holotype is in good condition and the genitalia are intact. The specimen has the left fore- and midlegs missing. The pupal and larval exuviae associated with the holotype are mounted in balsam on a microscope slide. The allotype is in excellent condition and possesses the same collection data as the holotype except the collection number, 596/7. The pupal and larval exuviae associated with the allotype are mounted in balsam on a microscope slide. Paratype labels are on 12 female and 6 male adult specimens (pupal and larval exuviae are also indicated) and are as follows: 592 1♂, 592/12 ♀pl, 593 1♀ and 1♂, 594 1♂, 594/9 ♀pl, 596 2♀ and 1♂, 596/4 ♀pl, 596/6 ♂pl, 598 2♀ and 1♂, 598/1 ♀pl, 598/5 ♀pl, 598/6 ♀pl, and 598/9 ♀pl. All these paratypes have the same collection data as the holotype except for the following: 592, 592/12, 593 (1♂) larvae in ground pool among nipah palms; 594, 596 (1♀) larvae in crab holes; 596 (1♀) larva in water between nipah palm fronds; and 598/1 larva in nipah palm frond. Mattingly (1958a: 32) reported the type-series was collected on 4: v : 1953 and consisted of the holotype, allotype and 6 male and 14 female paratypes. All the above specimens I examined were dated 4.3.53.

**DISTRIBUTION.** Fifty-six specimens examined: 3 ♂pl, 7♂, 10 ♀pl and 10♀.

**MALAYSIA.** Selangor, Rantau Panjang, 4 Mar. 1953, 598/4 (holotype); 596/7 (allotype); paratypes: 592, /12; 593; 594, /9; 596, /4, /6; 598, /1, /5, /6, /9, 2 ♂pl, 5♂, 8 ♀pl, 4♀, and May 1957, 037, 1♂ and 2♀; other than type-series, same location, 22 Aug. 1968, 1679, S. W. James, C. Y. Wang and S. bin Oman, 2♀; Kg. Rantau Panjang, Aug. 1957, J. A. Reid, 0275/1, /2, 0277/1, 0278/1, 1 ♂pl, 1♂, 1 ♀pl and 1♀.

#### *Distribution from literature.*

**MALAYSIA.** Selangor, Rantau Panjang (Mattingly 1958a: 32).

**DISCUSSION.** Adults of *bonneae* are easily identified by the scutum which is dark scaled and without pale scaled areas. This species also has broad dark scales on all lobes of the scutellum, paratergite bare, femora I-III without dorsoapical white scales, and antepronotum with both narrow curved and broad brown scales.

The male genitalia of *bonneae* are distinctive in the trifid gonostylus and the development of the basal mesal lobe, which has only 3 flattened setae on the dorsomesal arm (Fig. 4).

Female genitalia of *bonneae* are separated from those of the other species by the shape of tergum IX and sternum VIII and the setae being restricted to the apical area of tergum VIII.

The shape of the male genital lobe (Fig. 22) of the pupa of *bonneae* is unique in that the apex is broad and nearly truncate. Other features of the pupae are: base of 2-II inserted slightly laterad and cephalad of 3-II; 3-III inserted far laterad of 1-III; and 6-CT greater than 0.5 length of 7-CT. The latter feature, 6-CT, is shared by pupae of *chrysoscuta* and *ostentatio*, but differs from those of *collessi* and *thailandensis* in which 6-CT is less than 0.5 of the length of 7-CT.

The larva of *bonneae* can be identified by the pigmentation of the siphon which has the apical 0.4 more darkly pigmented than the remainder. *Aedes chrysoscuta* and *ostentatio* also have the apical portion of the siphon more heavily pigmented than the remainder; however, the apical 0.4 is very dark

colored while in *bonneae* it is more lightly colored. The antennal scape index is 9.84-10.97 for *bonneae*, but 11.75-12.50 for *ostentatio* and 15.31-16.90 for *thailandensis*.

**BIONOMICS.** In Malaysia larvae have been collected from water in crab holes, in ground pools among nipah palm trees and in nipah palm fronds during March, May and August. Females were taken in Malaysia biting man during August at a coastal village, at sea level, 10-99 m from houses, and in partial shade.

Mattingly (1958a: 34) records the immature habitats in Malaysia as ground pools, crab holes and nipah palm fronds.

#### *AEDES (PARAEDES) CHRYSOSCUTA (THEOBALD)*

(Figs. 5, 11, 18, 24, 27, 28)

*Pseudohowardina chrysoscuta* Theobald 1910: 228 (♀).

*Ochlerotatus ostentatio* of Edwards 1913: 228 (*in part*); Brunetti 1920: 140 (*in part*); Senior-White 1923: 81 (*in part*), 1927: 62.

*Aedes* (?) *ostentatio* of Edwards 1922b: 468 (*in part*); Brug and Bonne-Wepster 1947: 185 (*in part*).

*Aedes* (? *Aedimorphus*) *ostentatio* of Barraud 1928: 374 (♀), 1934: 267 (♀, *in part*); Edwards 1932: 171 (*in part*); Macdonald 1957: 21 (*in part*).

*Aedes* (*Aedimorphus*) *ostentatio* of Knight and Hull 1953: 463 (♀, *in part*); Chow, Thevasagayam and Tharumarajah 1954: 117; Horsfall 1955: 518 (*in part*).

*Aedes* (*Aedimorphus*) *ostentatio* of Carter 1950: 89, 106.

*Aedes* (*Paraedes*) *ostentatio* of Mattingly 1958a: 7, 9, 22, 24, 25 (♀, key, *in part*); Qutubuddin 1960: 138.

*Aedes* (*Paraedes*) *ostentatio* of Stone, Knight and Starcke 1959: 200 (*in part*); Basio 1971: 26 (*in part*); Stone and Delfinado 1973: 307 (*in part*); Harrison et al. 1974: 153; Knight and Stone 1977: 148 (*in part*).

**MALE.** *Head.* Antenna dark brown, 1.28-1.30 length of proboscis, pedicel pale golden-brown with a few short fine brown setae and small dark scales mesally; maxillary palpus 0.10 length of proboscis; clypeus pale golden-brown; proboscis 0.87-0.94 length of femur I; vertex covered with broad decumbent dark brown scales, a few narrow curved golden-white scales on interocular space, ocular line with narrow curved golden scales; lateral surface covered with broad dark brown scales and with a patch of broad white scales anterior to antepronotum and posterior to eye margin; occiput with a few short erect forked brown scales and a few broad decumbent white scales; interocular and ocular setae dark brown and well developed; eyes slightly separated anteriorly.

*Thorax.* Scutal integument moderately brown; scutum covered with narrow curved reddish-black scales, except for narrow curved golden scales on anterior promontory area, anterior scutal fossal area (some specimens also with golden scales on lateral scutal fossal area and a very narrow line on acrostichal area, a few along lateral margins of prescutellar bare space, and a small patch on supraalar area); scutum with reddish-black setae as follows: 2, 3 anterior promontory, numerous dorsocentral (anterior and posterior), scutal fossal (2-4 anterior, 1, 2 lateral and 1 posterior), numerous supraalar, 4 short posterior medial scutal; scutellum with a small patch of narrow curved reddish-black scales on each lobe (some specimens also with a few narrow curved golden scales on median lobe, 6-8 setae on median lobe, 3, 4 setae on lateral lobe; pleural integument pale golden-brown; antepronotum covered with

broad dark brown scales, 6-9 reddish-black setae; postpronotum with narrow curved reddish-black scales along dorsal margin and a small patch of 3-8 broad dark brown scales on posterior area in front of setae, 3, 4 reddish-black posterior setae; propleuron covered with broad white scales, 5-8 golden setae; paratergite bare; postspiracular area with 2-5 broad white scales (some specimens with scales rubbed off), 2-4 dark brown setae; mesepisternum with a large patch of broad white scales on upper area and a small patch of similar scales on lower area, 2, 3 setae on upper area and 8-12 setae on posterior area, lower setae short and pale; prealar knob with 5-8 dark brown setae; mesepimeron with a large patch of broad white scales, 8-15 short golden setae dorsad of scales. *Legs.* Coxae I-III with several dark brown setae, I with anterior surface with broad white scales, II and III with a small anterior patch of broad white scales; trochanters I-III with a few broad pale scales and a few short golden setae; femur I with anterior and posterior surfaces covered with dark brown scales, I also with a posteriodorsal pale scaled stripe from base to near apex, femur II with anterior and posterior surfaces dark brown scaled and a posteroventral longitudinal white scaled stripe on basal 0.7, stripe broader proximally, femur III dark brown scaled with an anteroventral and a posteroventral longitudinal white scaled stripe on basal 0.80-0.92, stripe broader proximally; posttarsi I-III (Fig. 27) with 2 unguis, I and II with unguis equal in size and with a tooth, III with unguis equal in size, both simple. *Wing.* Dorsal and ventral veins dark brown scaled; costa without a patch of white scales; alula with narrow brown scales along margin; 1, 2 short brown remigial setae; upper calypter bare. *Halter.* Pedicel pale; capitellum dark brown scaled. *Abdomen.* Terga dark brown scaled, II-VII with a small laterobasal patch of white scales, VIII white scaled with a few brown scales on posterior margin; sterna white scaled, III-VII with a narrow apical band of brown scales, VIII brown scaled, terga and sterna with short setae, mostly along posterior and lateral margins. *Genitalia* (Fig. 5). Tergum IX strongly bilobed, with 2-5 short setae on each lobe; gonocoxite with an apical sternomesal lobe, tergal surface with 3, 4 long stout and 9-12 moderately long setae and 3 irregular rows of setae on basal 0.75 of tergomesal margin, setae short distally and increase in length proximally until they become long at base, lateral surface with a few long and moderately long setae, sternal surface with a number of long stout and a few short setae on apical 0.25 and a subapical circular patch of approximately 35-45 moderately long and a few short setae on mesal margin, a single short seta at base near middle, lateral surface and lateral areas of tergal and sternal surfaces with scales; gonostylus with pedicel narrow and distal portion bifid and divided into a narrow club-shaped tergal arm bearing 11-17 short setae and a file-like area of spicules, and a flattened rectangular shaped sternal arm with small hair-like spicules on distal 0.55; basal mesal lobe divided at base into 2 long arms, mesal arm with distal 0.4 narrower, curved tergally and with 3 moderately long hook-like setae at apex, proximal 0.5 somewhat flattened, expanded distally, and covered with short hair-like spicules, outer arm very long, narrow and gently tapering from near base to apex, distal 0.4 narrower and covered with long dendritic spines, becoming more numerous distally, basal 0.5 cylindrical and with a short finger-like projection near base which bears 2, 3 short setae, one or 2 apically and one subapically; phallosome with aedeagus divided into 2 heavily pigmented lateral plates connected basally, each plate with one or 2 stout teeth, apical 0.3 with a lightly pigmented sternal connection, distal portion of each plate bluntly rounded with apex pointed and projected mesally, paramere approximately 0.96 length of lateral plate, parameral apodeme

moderately long and narrow; sternum IX large, with 2, 3 long stout setae near center.

**FEMALE.** The female differs markedly from the male in scale patterns of the head, thorax and legs and the number of thoracic setae. The following features differ from the male. *Head.* Antenna 1.41-1.52 length of proboscis; maxillary palpus 0.21-0.23 length of proboscis; proboscis 0.77-0.85 length of femur I; vertex covered with broad decumbent dark blackish-brown scales and a median triangular patch of narrow curved golden ones, numerous erect forked golden scales scattered throughout golden scale patch from occiput to interocular setae, a few erect forked dark scales also on lateral areas of occiput; interocular setae golden, well developed. *Thorax* (Fig. 24). Scutum covered with narrow curved reddish-black scales, narrow curved golden scales on the following: anterior promontory area, extending from anterior scutal fossal area over lateral scutal fossal area to scutal angle, a few on scutal ridge, a broad stripe on acrostichal area extending from anterior promontory area over posterior medial scutal area and along lateral margins of prescutellar bare space, a distinct narrow stripe on anterior dorsocentral area to approximately scutal ridge, and a small patch on supraalar area cephalad of wing base; scutellum with curved golden scales on all lobes, also usually a few narrow curved dark scales on posterior margins; setal differences are: 2-4 anterior promontory, 4-6 anterior scutal fossal, 6 posterior medial scutal, scutellum with 6, 7 lateral and 7-9 median, 8-10 antepronotal, 4-6 postpronotal, 7-10 propleural, 2, 3 upper and 8-18 posterior mesepisternal, 6-11 on prealar knob, and 10-16 mesepimeral; postspiracular area with a patch of broad white scales. *Legs.* Femora I-III with a small dorsoapical patch of white scales; posttarsi I-III (Fig. 28) with 2 unguis equal in size and with a tooth. *Wing.* Costa with a few broad pale scales at base; upper calypter with dark setae on margin. *Halter.* Capitellum with dark scales at base and white scales apically. *Abdomen.* Tergum VIII with a laterobasal patch of white scales. *Genitalia* (Fig. 11). Tergum VIII with 0-2 scales, basal 0.85-0.95 retracted into segment VII, base concave mesally, apex straight, numerous short setae scattered over apical 0.67-0.82, setae along apex short to moderately long, basolateral seta absent, VIII-Te index 0.74-0.82, VIII-Te/IX-Te index 2.19-2.31, length 0.25-0.27 mm, width 0.32-0.34 mm; sternum VIII with scales absent, base slightly concave mesally, apex with a moderately deep median indentation (0.11-0.13 of length) and a small lobe on each side of midline, short to moderately long setae on apical 0.92-0.98, apical intersegmental fold lightly pigmented, VIII-S index 0.66-0.73, length 0.27-0.30 mm, width 0.40-0.43 mm; tergum IX with apex with a small median indentation and with 3-5 short thin setae on each side of midline, 6-10 total setae, IX-Te index 0.79-0.84, length 0.11-0.12 mm, width 0.14-0.15 mm; insula with 2-4 small tuberculi; lower vaginal lip with numerous minute spicules; upper vaginal lip with vaginal sclerite moderately large, narrow; postgenital lobe with apex with a very small to small median indentation (0.04-0.11 of length), 11-13 (usually 11, 12) setae on each side of midline, 21-26 total setae, dorsal PGL index 0.90-1.07, ventral PGL index 1.45-1.73, ventral length 0.13-0.15 mm; cercus with 2 long stout setae at apex, dorsal surface with a number of short to moderately long setae on apical 0.73-0.83, 1-5 scales (usually 1-3), ventral surface with a few short setae on lateral margin, cercus index 2.81-3.32, cercus/dorsal PGL index 2.64-2.97, cercus length 0.25 mm; one large seminal capsule, base of accessory gland duct moderately to heavily pigmented.

**PUPA** (Fig. 18). Chaetotaxy as figured and recorded (Table 2). *Cephalothorax.* Seta 1-CT with 2-5 branches; 5-CT with 3-6 branches. *Respiratory*

*trumpet.* Index 5.51-6.31, mean 5.92. *Abdomen.* Seta 4-I with 4-8 (usually 6, 7) branches; 5-I with 2-4 (usually 2, 3) branches; 1-II with 10-23 branches; 2-II inserted mesad of 3-II; 10-III usually 4, 5 (3-5) branched; 7-IV single to 3 branched; 10-IV usually 3, 4 (2-5) branched; 1-V with 2-5 branches; 6-VI single. *Paddle.* With minute spicules on apical 0.52-0.56 of lateral and apical 0.13-0.14 of mesal margins; index 1.32-1.46, mean 1.41.

**LARVA** (Fig. 24). Description based on 5 larval exuviae with associated adults and 5 whole larvae. *Head.* Moderately pigmented; setae 0, 1, 3, 14, 18, 20-C single; 4-C with 9-13 (12) branches; short; 5-C with 4-6 (5) branches, very long; 6-C with 4, 5 (4) branches, very long; 7-C with 7-13 (9) branches, long; 8-C with 2, 3 (3) branches; 9-C with 2-5 (4) branches; 10-C with 2-6 (4) branches; 11-C with 4-6 (4) branches; 12-C with 5-10 (8) branches; 13-C with 5-9 (7) branches; 15-C with 3-5 (4) branches; dorsomentum with 30-34 (30) teeth, heavily pigmented. *Antenna.* Scape long, index 10.22-10.98, mean 10.53; seta 1-A with 4, 5 (4) branches, inserted 0.53-0.57 from base. *Thorax.* Seta 0-P with 8-19 (12) branches; 1-P with 2-4 (2) branches; 2-P single to 3 (2) branched; 3-P with 2-6 (3) branches; 4-P with 3-6 (4) branches; 5, 6, 10, 12-P single; 7-P with 2-4 (3) branches; 8-P single or 2 (1) branched, 9-P single to 3 (3) branched; 11-P with 2-5 (3) branches; 14-P with 2 branches; 1-M with 2-5 (4) branches; 2-M with 2-4 (3) branches; 3-M single or 2 (1) branched; 4-M with 3-7 (5) branches; 5, 7, 10-12-M single; 6-M with 4-6 (5) branches; 8-M with 5, 6 (5) branches; 9-M with 5-8 (7) branches; 13-M with 10-27 (16) branches; 14-M with 8, 9 branches; 1-T with 2-5 (3) branches; 2-T single to 6 (5) branched; 3-T with 7-17 (17) branches; 4, 9-T with 2-4 (3) branches; 5, 10, 11-T single; 6-T with 2, 3 (3) branches; 7-T with 5-9 (6) branches; 8-T with 5-10 (8) branches; 12-T with 2 branches; 13-T with 8-10 branches. *Abdomen.* Setae 0, 2, 7, 13-I single; 1, 6-I with 2, 3 (3) branches; 3-I with 4-8 (5) branches; 4-I with 9-17 (9) branches; 5-I with 3-5 (4) branches; 9-I with 2-4 (3) branches; 10-I with 2 branches; 11-I single or 2 (1) branched; 0, 2, 9, 14-II single; 1, 8-II with 2, 3 (3) branches; 3-II with 3-7 (7) branches; 4-II with 5-12 (10) branches; 5-II with 2, 3 (2) branches; 6-II with 2 branches; 7-II with 3-7 (4) branches; 10-II single to 4 (2) branched; 11-II single to 3 (2) branched; 12-II with 2-5 (4) branches; 13-II with 9-11 (11) branches; 0, 2, 9, 11, 14-III single; 1, 13-II with 5, 6 (6) branches; 3-III with 3-6 (6) branches; 4-III with 2-4 (2) branches; 5, 8-III single to 3 (2) branched; 6-III single or 2 (2) branched; 7-III with 4-9 (6) branches; 10-III with 2, 3 (3) branches; 11-III single or 2 (1) branched; 12-III with 2 branches; 0, 2, 9, 14-IV single; 1-IV with 5, 6 (6) branches; 3-IV with 5, 6 (5) branches; 4-IV with 2, 3 (2) branches; 5, 8-IV single to 2 (2) branched; 6, 11, 12-IV with 2 branches; 7-IV with 2-4 branches; 10-IV single to 3 (1) branched; 13-IV with 4 branches; 0, 2, 9, 14-V single; 1-V with 3-7 (5) branches; 3, 10, 13-V with 3, 4 (3) branches; 4-V with 6-9 (8) branches; 5, 6, 12-V single to 2 (2) branched; 7-V with 4-13 (6) branches; 8-V with 2, 3 (2) branches; 11-V with 2 branches; 0, 2, 9, 10, 14-VI single; 7-VI with 7 branches; 3-VI with 3-8 branches; 4-VI with 3-6 branches; 5-VI with 2-4 (2) branches; 6-VI single to 4 branched; 7-VI with 3-7 (4) branches; 8-VI single to 2 (1) branched; 11, 12-VI with 2 branches; 13-VI with 12-20 (12) branches; 0, 2, 14-VII single; 1-VII with 2-5 (3) branches; 3-VII with 5-7 (7) branches; 4, 5-VII with 4, 5 (5) branches; 6-VII with 10-14 branches; 7-VII with 2-4 (4) branches; 8-VII with 9-13 branches; 9-VII with 3 branches; 10-VII with 3-5 branches; 11-VII single or 2 (2) branched; 12-VII with 3, 4 (3) branches; 13-VII with 7-11 branches; 0, 14-VIII single; 1-VIII with 3-7 (4) branches; 2-VIII with 2-4 (3) branches; 3-VIII with 3-9 (7) branches; 4-VIII single to 3 (1) branched; 5-VIII with 4-7 (5) branches; comb on VIII with 12-16

(usually 14-16) scales; 1-X single to 3 (2) branched; 2-X with 4-7 (6) branches, moderately long; 3-X single, long; 4-X with 8, 9 setae on grid, each with 8-16 branches and one short precratal seta. *Siphon*. Moderately to heavily pigmented, apical 0.4 very heavily pigmented, dark brownish-black; index 3.37-4.20, mean 3.76; pecten on basal 0.51-0.56, with 12-16 (usually 14-16) teeth, each tooth with one or 2 small ventral denticles near base, apex long, narrow and pointed, distal 1-3 teeth spine-like, without denticles and wider spaced than remainder; 1-S with 2-6 (5) branches, inserted on basal 0.68-0.69 of siphon and distad of last pecten tooth; 2-S single, short; 6, 7, 9-S single; 8-S with 2 branches.

**TYPE-DATA.** The holotype female of *Pseudohowardina chrysoscuta* Theobald is in the BMNH and possesses the following data: Peradeniya, Ceylon, 4-07, Green; *Pseudohowardina chrysoscuta* Type ♀, F. V. T.; Type.

**DISTRIBUTION.** Ninety specimens examined: 10 ♂pl, 5 ♂p, 2 ♂, 12 ♀pl, 1 ♀p, 3 ♀, 3 larval exuviae, 3 larvae and 1 pupa.

**SRI LANKA.** Central, Kandy District, Kandy, Peak View Motel, 15-24 Jan. 1970, D. R. Davis and W. H. Rowe, 1 ♂ and 2 ♀; same province and district, Wakarwatte, 23-24 Jun. 1975, 75-2; 76-1, -2, -3, -4; 78-1, -2, -3; 79-1; 83-1, -2, -3, -4, -5, -100, -101, -103, -104, -105, -106; 84, 84-1, -2, -3, -4; 85, 85-2, -3, E. L. Peyton and Y-M. Huang, 10 ♂pl, 5 ♂p, 1 ♂, 10 ♀pl, 1 ♀p, 1 ♀, 1P, 3L, 3I; same except Udawattekele, 25 Jun. 1975, 109-1, 1 ♀pl. Western, Alutgama, 26 Oct. 1978, No. 56, N. Jayasekera, 1 ♀pl.

#### *Distribution from literature.*

INDIA (Bohart 1945: 63; Brug and Bonne-Wepster 1947: 185); Malabar Coast (Barraud 1928: 374, 1934: 268; Mattingly 1958a: 28, questions the records from India).

**SRI LANKA** (Bohart 1945: 63; Brug and Bonne-Wepster 1947: 185); Peradeniya (Theobald 1910: 224), Bibile (Barraud 1934: 268); Central, Kandy District, Kandy, Peak View Motel (Harrison et al. 1974: 153); Bibile (Mattingly 1958a: 26).

**DISCUSSION.** Adults of *chrysoscuta* are similar in habitus to those of *ostentatio*. Prime differences useful in distinguishing the 2 species follow, for *chrysoscuta*: pleural integument, antennal pedicel, and clypeus each pale golden-brown; antepronotum of female covered with broad dark brown scales; costa of female wing with a few pale scales at base; female posttarsus III with both unguis toothed; female antenna length 1.41-1.52 of proboscis; female palpus length 0.21-0.23 of proboscis; female proboscis length 0.77-0.85 of femur I; and male antennal length 1.28-1.30 of proboscis; and for *ostentatio*: pleural integument, antennal pedicel, and clypeus each dark brown; antepronotum of female covered with broad dark brown scales and a small patch of broad white scales; costa of female wing completely brown scaled; female posttarsus III with both unguis simple; female antennal length 1.27-1.35 of proboscis; female palpus length 0.18-0.19 of proboscis; female proboscis length 0.91-0.99 of femur I; and male antennal length 1.17-1.21 of proboscis.

The sexes of *chrysoscuta* are dimorphic in the pale scaled patterns of the head and scutum. These pale scaled patterns are also variable between individuals from the same collection.

Male genitalia of *chrysoscuta* closely resemble those of *ostentatio*, however, they can be separated by the following, in *chrysoscuta*: sternal surface of gonocoxite with a subapical patch of 35-45 setae; tergal surface of gonocoxite with 3 irregular rows of setae on basomesal area, setae short distally and long basally; sternal surface of gonocoxite with a single long stout seta on median basal area; and basal mesal lobe bifid with one arm gently tapering

from base to a pointed apex and with long dendritic spines on apical 0.4; and in *ostentatio*: sternal surface of gonocoxite with a subapical patch of 20-25 setae; tergal surface of gonocoxite with one or 2 irregular rows of setae on basomesal area, setae short distally and moderately long basally; sternal surface of gonocoxite almost always without a single long stout seta on median basal area; and basal mesal lobe bifid with one arm swollen near middle and with short simple spines near middle and on apical 0.25. The male genitalia of both *chrysoscuta* and *ostentatio* are unique and easily separated from those of the other species of the subgenus in the development of the basal mesal lobe in that one of the arms does not have stout flattened setae.

Female genitalia of *chrysoscuta* are similar to those of *ostentatio*. They can be separated by the following, in *chrysoscuta*: sternum VIII length 0.40-0.43 mm; tergum VIII length 0.32-0.34 mm; postgenital lobe with 21-26 setae; cercus length 0.25 mm; cercus index 2.81-3.32; and tergum IX index 0.79-0.84; and in *ostentatio*: sternum VIII length 0.35-0.40 mm; tergum VIII length 0.25-0.31 mm; postgenital lobe with 14-17 setae; cercus length 0.17-0.19 mm; cercus index 2.20-2.58; and tergum IX index 0.67-0.75.

The pupa of *chrysoscuta* is very similar to that of *ostentatio*, but can be distinguished by the usual branching of setae 4, 5-I and 10-III, IV.

Larvae of *chrysoscuta* and *ostentatio* are very similar. The 2 species can be separated by the following, in *chrysoscuta*: seta 1-P with 2-4 branches; 8-M with 5, 6 branches; 7-IV with 2-4 branches; 8-VI single or 2 branched; and scape index 10.22-10.98; and in *ostentatio*: seta 1-P single; 8-M with 7-9 branches; 7-IV with 7-10 branches; 8-VI with 3-5 branches; and scape index 11.75-12.50. Also, larvae of *chrysoscuta* usually have 14-16 (12-16) comb scales while those of *ostentatio* usually have 9-12 (9-14) comb scales.

**BIONOMICS.** Adults were taken in Sri Lanka in a Malaise trap at an elevation of 549 m.

In Sri Lanka immatures were collected 9 times from fresh water in both small and large crab holes located in partial shade of a secondary rain forest in mountainous and valley terrain, and at 600 m elevation during June and October.

Adults from Sri Lanka were collected in April (Theobald 1910: 229) and January at an elevation of 1800 ft (Harrison et al. 1974: 153).

#### *AEDES (PARAEDES) COLLESSI MATTINGLY*

(Figs. 2, 6, 12, 19, 22, 25, 27, 28)

*Aëdes (Paraëdes) collessi* Mattingly 1958a: 13, 18, 21, 22, 24, 25, 27, 28  
(♀\*, ♂\*, P\*, L\*, keys).

*Aedes (Paraedes) collessi* of Stone, Knight and Starcke 1959: 199; Stone and Delfinado 1973: 306; Knight and Stone 1977: 148.

**MALE.** Description based on holotype and 2 other males. *Head.* Antenna dark brown, 1.20-1.21 length of proboscis, pedicel golden-brown with a few short fine setae mesally; maxillary palpus 0.09 length of proboscis; clypeus golden-brown; proboscis 0.96-1.07 length of femur I; vertex and lateral surfaces covered with broad decumbent dark blackish-brown scales and with a very small patch of broad pale scales anterior to antepronotum and posterior to eye margin; occiput with a few short erect forked dark brown scales; interocular space covered with broad dark blackish-brown scales; ocular and interocular setae dark brown and well developed; eyes separated anteriorly. *Thorax.*

Scutal integument dark brown; scutum covered with narrow curved dark reddish-brown scales except for a very small patch of narrow curved pale scales on anterior promontory area; scutum with dark setae as follows: 3, 4 anterior promontory, numerous dorsocentral (anterior and posterior), scutal fossal (3 anterior, 2, 3 lateral and 1 posterior), numerous supraalar, 4 posterior medial scutal; scutellum with narrow curved reddish-brown scales on each lobe, 4 setae on median lobe, and 2, 3 setae on lateral lobe; pleural integument light brown; antepronotum with a few narrow curved dark brown scales (one specimen also with 2, 3 broad dark brown scales), 6-8 dark setae; postpronotum with a few narrow curved dark reddish-brown scales on upper area, 3 dark posterior setae; propleuron with a few broad white scales, 3, 4 setae; paratergite bare; postspiracular area with 1, 2 dark setae; mesepisternum with a moderately large patch of broad white scales on upper area and a small patch of similar scales on lower area, 1, 2 dark setae on upper area and 6 setae on posterior area, lower setae short and pale; prealar knob with 5, 6 dark setae; mesepimeron with a large patch of broad white scales, 6-8 short setae dorsad of scales. *Legs.* Coxae I-III with several setae, I with anterior surface with broad scales, white scaled on upper area and pale brown scales on lower area, II and III with a small patch of broad white scales on anterior surface; trochanters I-III with a few pale brown and white broad scales and a few short setae; femora I-III with anterior surface brown scaled, I-III with posterior surface brown scaled, and II and III also with a pale scaled ventral stripe from base to near apex; posttarsi I-III (Fig. 27) with 2 unguis equal in size and with a tooth. *Wing.* Dorsal and ventral veins dark brown scaled; costa without a patch of white scales; alula with narrow dark brown scales on margin; one dark remigial seta; upper calypter apparently without setae. *Halter.* Pedicel pale, capitellum dark brown scaled. *Abdomen.* Terga II-VII dark brown scaled and with a moderately large patch of broad white scales on laterobasal area, VIII dark brown scaled with 1-3 white scales on laterobasal area; sterna white scaled with a posterior band of brown scales, VIII brown scaled; terga with a few short brown setae on lateral and posterior margins. *Genitalia* (Fig. 6). Tergum IX moderately pigmented, bilobed, with 3, 4 short setae on each lobe, cephalic margin emarginate, lateral margin narrowly connected to sternum IX; gonocoxite heavily pigmented, tergal surface with long setae on apical 0.5, a row of 9, 10 short to moderately long setae on mesal area extending from near base to approximately 0.3 from apex, 1-3 broad scales, a few very long stout setae along lateroapical surface, sternal surface with an apical patch of long stout setae extending along mesal margin as a closely set row to approximately 0.5 from base, a few scattered setae on basal and lateroapical areas, a number of broad scales on sternal and lateral surfaces, tergal, sternal and lateral surfaces covered with minute spicules; gonostylus approximately 0.73 length of gonocoxite, bifid, with inner arm large and with apex bluntly rounded, a large patch of spicules forming file-like ridges, a row of 8, 9 short setae along inner margin of this patch, 4, 5 short setae along outer margin, other arm short, curved sternomesally, apex pointed and slightly re-curved, outer margin with short ridges of spicules on apical area; basal mesal lobe divided at base into 2 long caudally projecting arms, dorsomesal arm with base broad, flattened, mesal area expanded into a point, covered with numerous long spicules, apical area narrow and terminating with 3 short dark blunt flattened setae, ventral arm long, narrow, basal portion curved ventrad, entire surface covered with minute spicules, apex with 3 moderately long stout setae; phallosome with aedeagus divided into 2 heavily pigmented lateral plates connected basally, each plate curved tergomesad and with 1, 2

long basomesal teeth, a lightly pigmented dorsal flap covering lateral plates, paramere approximately 1.02 length of aedeagus, parameral apodeme moderately broad, approximately 1.17 length of paramere; sternum IX moderately to heavily pigmented, apical margin rounded and extended far cephalad, 2 long stout setae on caudomesal area.

**FEMALE.** The female differs markedly from the male in the scale patterns of the head and thorax and the number of thoracic setae. The following features differ from the male. *Head.* Antenna 1.15-1.30 length of proboscis, flagellomere 1 approximately 0.75 length of combined lengths of 2 and 3, 1 also with several small broad dark scales on basal 0.5, pedicel with a few small broad pale brown scales mesally in addition to short fine hairs; maxillary palpus 0.17-0.20 length of proboscis; clypeus dark brown; proboscis 0.99-1.03 length of femur I; vertex with broad decumbent dark blackish-brown scales and a large triangular patch of narrow curved golden scales extending from occiput anteriorly over interocular space, similar golden scales on ocular line; lateral surface with a larger patch of broad white scales anterior to antepronotum; occiput with numerous erect forked golden scales and similar scales extending onto posterior portion of vertex which is golden scaled.

*Thorax* (Fig. 2). Scutum with narrow curved reddish-brown scales, but with narrow curved golden scales on following areas: broad stripe extending from anterior promontory area over anterior and posterior acrostichal areas and onto posterior medial scutal area at which point it forks and forms a narrow stripe along lateral margins of prescutellar bare space, similar scales covering anterior scutal fossal area and anterior dorsocentral area to just posterior of scutal ridge, golden scales on dorsocentral and acrostichal areas combined cover most of anterior median area of scutum, golden scales also on anterior and anterior portion of lateral scutal fossal areas, a small patch at scutal angle and a medium size patch on supraalar area (golden scaled areas somewhat variable, some specimens with a few narrow curved reddish-brown scales on areas between anterior acrostichal and anterior dorsocentral areas); setal differences are as follows: 3-5 anterior promontory, scutal fossal (3, 4 anterior, 2-4 lateral and 1 posterior), 0-3 anterior acrostichal; scutellum with narrow curved golden scales on each lobe, lateral lobes of some specimens also with a few narrow curved reddish-brown scales, 4-6 setae on median lobe, 4-6 setae on lateral lobe; pleural integument dark brown; antepronotum with numerous narrow curved dark reddish-brown scales, 8-11 dark setae; postpronotum with narrow curved dark reddish-brown scales on dorsal and posterior areas, 4-6 dark posterior setae; propleuron with a large patch of broad white scales, 5-9 setae; paratergite bare (allotype with a few narrow curved reddish-brown scales on posteriolateral area); postspiracular area with several broad white scales posterior to setae, 2-4 dark setae; mesepisternum with a large patch of broad white scales on upper area and a medium size patch of similar scales on lower area, 2, 3 upper and 7-11 posterior setae; prealar knob with 4-8 dark setae; mesepimeron with 9-11 setae dorsad of large patch of broad white scales. *Legs.* Coxae I with anterior surface dark brown scaled with a small patch of white scales on dorsal area; femur III with anterior surface brown scaled with a broad ventral white scaled stripe from base to near apex, I-III with posterior surface brown scaled with a white scaled stripe from base to near apex, stripe dorsal on I and ventral on II and III, II and III also with a small white scaled dorsoapical patch, white scales also extending onto dorsal areas of anterior and posterior surfaces (some specimens also with a few dorsoapical white scales on I); posttarsi I-III (Fig. 28) with 2 unguis equal in size and simple. *Wing.* Costa with a small white

scaled patch at base; upper calypter with a number of narrow dark setae on margin. *Abdomen*. Terga II-VII dark brown scaled with a large laterobasal white scaled patch. *Genitalia* (Fig. 12). Tergum VIII with scales absent, basal 0.75-0.90 retracted into segment VII, base concave, apex straight, numerous short setae scattered over apical 0.79-0.83, setae along apex short and thin, basolateral seta absent, VIII-Te index 0.64-0.68, VIII-Te/IX-Te index 1.73-1.89, length 0.15-0.17 mm, width 0.23-0.26 mm; sternum VIII with scales absent, base slightly concave mesally, apex with a moderately deep to deep median indentation (0.17-0.20 of length) and a small lobe on each side of midline, short to moderately long setae on apical 0.77-0.94, seta 2-S approximately 0.38 from 1-S, seta 3-S approximately 0.62 from 2-S, apical intersegmental fold lightly pigmented, VIII-S index 0.60-0.65, length 0.19-0.21 mm, width 0.31-0.32 mm; tergum IX with apex with a small median indentation and with 3-5 (usually 3, 4) short thin setae on each side of midline, 6-9 total setae, IX-Te index 0.76-0.85, length 0.09-0.10 mm, width 0.11-0.12 mm; insula with 5, 6 small tuberculi; lower vaginal lip with numerous short spicules scattered over entire surface; upper vaginal lip with upper vaginal sclerite moderately pigmented, moderately large size; postgenital lobe with apex with a very small median indentation (0.07-0.08 of length), 6-9 (usually 7, 8) setae on each side of midline, 14-17 total setae, dorsal PGL index 0.90-0.96, ventral PGL index 1.52-1.56, ventral length 0.09-0.10 mm; cercus with 2, 3 long stout setae at apex, dorsal surface with a number of short to moderately long setae on apical 0.70-0.88, scales absent, ventral surface with a few short setae on lateral margin, cercus index 2.51-2.54, cercus/dorsal PGL index 2.78-3.08, cercus length 0.17 mm; one large seminal capsule, base of accessory gland duct heavily pigmented.

**PUPA** (Figs. 19, 22). Chaetotaxy as figured and recorded (Table 3). *Cephalothorax*. Setae 1, 5-CT with 2 branches; 9-CT single or 2 branched. *Respiratory trumpet*. Somewhat swollen at middle; index 3.33-4.46, mean 3.83. *Abdomen*. Seta 1-II with 5-14 branches; 2-II inserted laterad of 3-II; 1-III with 2, 3 branches; 6-III single; 1-IV-VI single or 2 branched; 3, 6-V single; 4-V with 2-4 branches; 1-VII single. *Paddle*. With minute spicules on apical 0.42-0.48 of lateral and apical 0.16-0.18 of mesal margins; index 1.94-2.22, mean 2.04.

**LARVAE** (Fig. 25). Description based on 6 larval exuviae with associated adults. *Head*. Moderately to heavily pigmented; setae 0, 1, 3, 14, 18, 20-C single; 4-C with 5-7 (7) branches; 5-C with 5-7 (6) branches; 6-C with 4, 5 (4) branches; 7-C with 9-13 (11) branches; 8-C with 2, 3 (2) branches; 9-C with 2-5 (4) branches; 10-C with 3, 4 (3) branches; 11-C with 2-6 (5) branches; 12-C with 6-10 (7) branches; 13-C with 5-8 (6) branches; 15-C with 2, 3 (3) branches; dorsomentum with 29-33 teeth, heavily pigmented. *Antenna*. Scape moderately long, index 10.00-11.61, mean 10.80; seta 1-A with 4-6 (5) branches, inserted 0.54-0.61 from base. *Thorax*. Seta 0-P with 12-20 (17) branches; 1, 5, 6, 8, 10, 12-P single; 2, 14-P with 2, 3 (2) branches; 3-P with 3, 4 (4) branches; 4-P with 3, 4 (3) branches; 7-P with 2, 3 (3) branches; 9-P single or 2 (2) branched; 11-P with 2-6 (3) branches; 1-M with 4 branches; 2-M with 3 branches; 3, 5, 7, 10, 12-M single; 4-M with 2-5 (4) branches; 6-M with 5-7 (6) branches; 8-M with 5-9 (6) branches; 9-M with 6-8 (8) branches; 11-M single or 2 (1) branched; 13-M with 22-25 (22) branches; 14-M with 13-20 (18) branches; 1-T single to 4 (4) branched; 2-T with 2-4 (4) branches; 3-T with 8-14 (11) branches; 4-T with 3-5 (5) branches; 5, 10-T single; 6-T with 2 branches; 7-T with 4-8 (5) branches; 8-T with 7-14 (10) branches; 9-T with 3, 4 (3) branches; 11, 12-T single or 2 (1) branched; 13-T with 12-20 (18)

branches. *Abdomen.* Setae 0, 4, 14-VIII single; 1-VIII with 5-7 (6) branches; 2-VIII single or 2 (2) branched; 3-VIII with 6-10 (8) branches; 5-VIII with 5-8 (5) branches; comb on VIII with 7-10 (usually 8, 9) scales; 1-X single or 2 (2) branched; 2-X with 7-12 (9) branches; 3-X single; ventral brush with 10 setae on grid, each with 2-14 branches, some setae always with 8 or more branches, cephalic setae shorter and with fewer branches. *Siphon.* Moderately pigmented with basal 0.4 heavier pigmented; index 3.13-3.91, mean 3.57; pecten on basal 0.42-0.53, with 12-16 (usually 13, 14) teeth, each tooth with one or 2 small ventral denticles near base, apex long, narrow and pointed, distal 1-3 teeth spine-like, without denticles and wider spaced than remainder; 1-S with 2-5 (2) branches, inserted on basal 0.57-0.60 of siphon distad of last pecten tooth; 2-S single, short; 6, 7, 8, 9-S single.

**TYPE-DATA.** The holotype male, deposited in the BMNH, possesses the following data on the adult labels: SELANGOR, Rantau Panjang, Mar. 1956 [on upper surface of label]; Ex. Coll. I. M. R. Malaya [on lower surface of label]; No. 013/1, Larvae in progeny raised in lab., Mother caught attacking man; *Aedes (Aedi.)* near *ostentatio*; *Aë. (Paraëdes) collessi* Mattingly HOLOTYPE, P. F. Mattingly 20: viii: 1957; and Type [circular label with a red border]. The holotype adult is in very poor condition and has only the following structures remaining on the pin; fragment of the thorax, both wings, left midleg, and most of the abdomen. The genitalia are mounted in balsam on a small cover glass on a card attached to the pin and one leg is mounted on a second small cover glass on a card attached to the pin. Associated larval and pupal exuviae are mounted in balsam under separate cover glasses on a microscope slide and are in good condition. The allotype is in excellent condition and possesses the same collection data as the holotype except the number 013/2. One paratype female, number 013/3, has the same data as the holotype. The allotype and paratype each have associated larval and pupal exuviae mounted in balsam on microscope slides. Another female specimen has a paratype label and the same data as the holotype except for the following: 1953, H.B.T. [human bait trap], and J. A. Reid collector. This specimen was not mentioned by Mattingly (1958a: 28).

**DISTRIBUTION.** Fifty-five specimens examined: 1 ♂pl, 1 ♂p, 1 ♂, 5 ♀pl and 34 ♀.

**MALAYSIA.** Sabah, Tenom, Mandalom Forest Reserve, 9 Apr. 1970, S-405, -440, S. bin Omar, C. Y. Wang and Ho, 20♀; Kudat, 20 Aug. 1966, 459, 2♀; Lingan Patpar (? spelling), 25 Jun. 1966, 455, 1♀; Timbang Kota Belud (? spelling), 24 Jun. 1966, 460, 1♀. Selangor, Kula Selangor, 1968, S-315, -111, 1 ♂p, 1 ♂; Puchong, May 1956, 0.27, 1♀; Rantau Panjang, Mar. 1953, 013/1 (holotype), 013/2 (allotype), 013/3 (paratype), 1 ♂pl and 2 ♀pl; 11 Feb. 1953, 593/1, J. A. Reid, 1 ♀pl; Mar. 1953, 593/2, /3, 2 ♀pl; 1953, J. A. Reid, 1 ♀ paratype and 1♀; 21 Nov. 1952, J. A. Reid, 1 ♀; 19 Mar. 1953, J. A. Reid, 2 ♀; Apr. 1956, 1 ♀; Kuala Lumpur, Gombak Rd., 28 Feb. 1904, G. F. Leicester, 2♀.

#### *Distribution from literature.*

**MALAYSIA.** Selangor, Rantau Panjang (Mattingly 1958a: 28; Macdonald 1957: 21; Wharton et al. 1964: 68); Selangor, Sabak Bernam Dist., Torkington Estate (Univ. Calif. Internat. Center Med. Res. Ann. Prog. Rep. 1979: 29); Perak, Parit, Mukim Kampung Gajah (Ann. Rep. Inst. Med. Res. for 1965, Malaysia, 1968: 32); Puchong (Macdonald 1957: 21).

**DISCUSSION.** Adults of *collessi* are similar to those of *menoni* and *pagei*. The 3 species, however, can be separated by the following features in the female: scutal pale scale patterns different (see Fig. 2); *collessi* with ante-

pronotum with narrow curved reddish-brown scales, postpronotum with 3 setae and narrow curved reddish-brown scales, 0-3 (usually 2, 3) anterior acrostichal setae, 4 posterior medial scutal setae, and with narrow curved golden scales on interocular space; *menoni* with antepronotum with narrow curved reddish-brown scales on inner area and narrow curved golden scales on outer surface, postpronotum with 4-6 setae and a few narrow curved golden scales, acrostichal setae absent, 4 posterior medial scutal setae, and with narrow curved white scales on interocular space; and *pagei* with antepronotum with narrow curved reddish-brown scales on inner area and narrow curved golden scales on outer surface, postpronotum usually with 3 (some specimens with 4) setae and narrow curved reddish-brown scales, 6 posterior medial scutal setae, and with narrow curved golden scales on interocular space.

The following combination of features distinguishes females of *collessi* from other species of *Paraedes*: eyes separated in front; scutal pale scaled pattern (see Fig. 2); antepronotum with narrow curved reddish-brown scales; scutellum with narrow curved golden scales on each lobe (some specimens also with narrow curved reddish-brown scales on median lobe); costa with a small white scaled patch at base; and femora II and III with a small dorso-apical patch of white scales.

Males of *collessi* can be distinguished from those of *menoni* by the following: *collessi* with pale scales on anterior promontory area; maxillary palpus 0.09 length of proboscis; antepronotum with narrow curved reddish-brown scales (one specimen also with a few broad brown scales) and 6-8 setae; postspiracular area with 1, 2 setae; prealar knob with 5, 6 setae; mesepimeron with 6-8 setae dorsad of scale patch; and characters of the genitalia (see Fig. 6); and *menoni* possesses: pale scales on anterior promontory, anterior and lateral scutal fossal areas and scutal angle; maxillary palpus 0.12 length of proboscis; antepronotum with broad brown scales and 11, 12 setae; post-spiracular area with 3, 4 setae; mesepimeron with 9, 10 setae dorsad of scale patch; and characters of the genitalia (see Fig. 7).

Pupae of *collessi* are distinguished by: seta 1-CT with 2 branches, 5-CT with 2 branches, 1-III with 2, 3 branches, 6-III single, 1-IV-VI single or 2 branched, paddle index 1.94-2.22, and shape of the male genital lobe (see Fig. 22).

*Aedes collessi* larval features of importance in separating this species from the others of the subgenus are: seta 8-S single, 1-S inserted on basal 0.57-0.60 of siphon, and siphon with basal 0.4 darker pigmented than apical 0.4.

**BIONOMICS.** Females in Malaysia have been collected in both human and calf baited traps. Adults were taken during the months of February through June and August. Larvae were collected from water in a small pool in the jungle and in a ground pool among nipah palm trees during February and March.

In Malaysia Wharton et al. (1964: 68) obtained females from a net trap baited with a man at ground level and from net traps baited with *Macaca* monkeys at ground level and on platforms in trees. Mattingly (1958a: 29, 31) reported that females were taken biting man or in human baited traps and larvae were collected from ground pools and, in one case, in a ground pool located in nipah palms. In Malaysia *collessi* was also collected from Berok baited traps, dissected and found negative for filaria parasites (Ann. Rep. Inst. Med. Res. for 1963, Fed. Malaya, 1968: 48, 63).

*AEDES (PARAEDES) MENONI MATTINGLY*

(Figs. 2, 7, 13, 28)

*Aedes (Paraëdes) menoni* Mattingly 1958b: 77 (♀\*, ♂\*); of Qutubuddin 1960: 135.*Aedes (Paraëdes) Travancore* sp. of Mattingly 1958a: 24 (keys).*Aedes (Paraëdes) menoni* of Stone, Knight and Starcke 1959: 200; Stone and Delfinado 1973: 207; Knight and Stone 1977: 148.

**MALE.** The following description is of the holotype. *Head.* Antenna brown, 1.16 length of proboscis, pedicel golden-brown with a few short fine setae and a few small brown scales mesally; maxillary palpus 0.12 length of proboscis; clypeus golden-brown; proboscis 0.94 length of femur I; vertex covered with broad decumbent dark brown scales except for a few erect forked golden scales on posterior area, narrow curved golden-white scales on ocular line, lateral surface with broad dark brown scales and a small patch of broad white scales on median anterior margin at level with antepronotum; occiput with a few narrow decumbent white scales and numerous erect forked golden-brown scales; interocular space with narrow curved golden-white scales, 2 pairs of brown setae; several dark brownish-black ocular setae; eyes slightly separated anteriorly. *Thorax.* Scutal integument dark golden-brown; scutum badly rubbed but remaining scales indicate that entire surface covered with narrow curved reddish-brown scales except for narrow curved white scales on the following: 4 on anterior promontory area, a small patch on anterior and extending onto lateral scutal fossal areas, and a small patch on scutal angle; scutum with dark brown setae as follows: 4 anterior promontory, numerous dorsocentrals (anterior and posterior), scutal fossal (4 anterior, 2 lateral and 1 posterior), numerous supraalar, 4 posterior medial scutal; scutellum with a patch of narrow curved reddish-brown scales and a few narrow curved white scales on basal area of lateral lobe, median lobe with only 3 narrow reddish-brown scales remaining, 4 long and 3 short setae on median lobe, 2 long and 2 short setae on lateral lobe; pleural integument golden-brown; antepronotum with broad dark brown scales, 11, 12 dark setae; postpronotum with several narrow curved reddish-brown scales on dorsal area, 3, 4 dark posterior setae; propleuron with a patch of broad silvery-white scales, several golden-brown setae; paratergite bare; postspiracular area with 3, 4 golden-brown setae; mesepisternum with broad silvery-white scales, a few remaining on upper area and a small patch on lower area, 3 upper and 9 (?) posterior brown setae; prealar knob with 7, 8 golden-brown setae; mesepimeron with a patch of broad silvery-white scales on upper area, 9, 10 golden setae dorsad of scale patch. *Legs.* Coxae I-III with golden-brown setae, I with broad white scales and a small median patch of broad brown scales on anterior surface, II and III with a patch of broad white scales on lateral surface; trochanters I-III with a few pale scales and a few short setae; femora I-III with anterior surface brown scaled, I-III with posterior surface brown scaled except for pale scaled areas as follows: I with a narrow dorsal longitudinal stripe from base to apex, II with a similar stripe on ventral area, and III with a large ventrobasal patch which narrows apically; posttarsi I-III with 2 unguis, I and II with unguis unequal in size, both simple, III with unguis equal in size, both simple. *Wing.* Dorsal and ventral veins with dark brown scales; costa without a patch of white scales; alula with several narrow brown scales on margin; no remigial setae seen; upper calypter apparently without setae. *Halter.* Pedicel pale; capitulum brown scaled with a few pale scales at base. *Abdomen.* Only basal

2 segments remain on specimen, remainder mounted on slide with genitalia. Tergum II brown scaled with a small laterobasal patch of broad white scales; sternum II with a few pale brown scales. *Genitalia* (Fig. 7). Genitalia of holotype damaged and in poor condition. Tergum IX moderately to heavily pigmented, bilobed, with 8, 9 short thin setae on each lobe, cephalic margin slightly emarginate, gonocoxite moderately to heavily pigmented, moderately long, moderately broad, mostly denuded of setae and scales but appears to have 4 short and 2 longer setae on basomesal area of tergal surface, a few scattered moderately long setae on median lateral area and a group of long stout setae on apical area of tergal surface, sternal surface with a patch of moderately long and long setae on apicomesal area, a few moderately long and long setae scattered over remainder of sternal surface, several broad scales on lateral and sternal surfaces, tergal, sternal and lateral surfaces covered with minute spicules; gonostylus approximately 0.69 length of gonocoxite, bifid at approximately 0.61 from base, basal area moderately broad, inner arm narrow with a row of short stout recurved spicules on apicolateral area and 3, 4 minute setae basad of spicules, outer arm curved mesad, short, narrow but with apical area somewhat broader and covered with short rows of spicules forming file-like ridges; basal mesal lobe divided at base into 2 long caudally projecting arms, dorsal arm with basal area narrow and apical portion broader and flat with 4 short flattened setae on apical margin, ventral arm long, narrow, curved, basal portion covered with short spicules, apex with 3 long setae; phallosome with aedeagus divided into 2 heavily pigmented lateral plates which are connected basally, each plate curved tergomesad with 2, 3 basomesal teeth, paramere approximately 0.98 length of aedeagus, parameral apodeme narrow; sternum IX moderately to heavily pigmented with 2 long stout setae on caudomesal area.

**FEMALE.** Features differing from male are listed below. Description based on allotype and 2 paratypes. *Head.* Antenna 1.31-1.39 length of proboscis; maxillary palpus 0.19-0.21 length of proboscis; proboscis 0.89-0.97 length of femur I; vertex with larger area of narrow curved golden-white scales, lateral surface with white scaled patch larger; occiput with erect forked scales more numerous. *Thorax* (Fig. 2). Scutum covered with narrow curved reddish-brown scales except for narrow curved golden scales as follows: a small patch on anterior promontory area, a large moderately broad patch on anterior and lateral scutal fossal area extending onto scutal angle, a narrow patch along scutal ridge and onto posterior dorsocentral area, a few scales forming indistinct lines on posterior dorsocentral and acrostichal areas (one specimen with a few scales on anterior acrostichal area) and along lateral margins of prescutellar bare space, and a small patch on supraalar area; scutellum with narrow curved golden-white scales on all 3 lobes; setal differences are as follows: 3, 4 anterior promontory, scutal fossal (4, 5 anterior and 2-4 lateral), scutellar (4-6 long and 3-5 short setae on median lobe, 2-4 long and 2-4 short setae on lateral lobe); 8-12 antepronotal, 4-6 postpronotal, 1-4 postspiracular, 2, 3 upper and 7-10 posterior mesepisternal, and 6-18 mesepimeral; antepronotum with narrow curved reddish-brown scales on dorsal half and narrow curved golden-white scales on ventral half; postpronotum with a few golden-white scales dorsad of narrow curved reddish-brown scales. *Legs.* Femur III with an indistinct basoventral patch of pale scales; posttarsi I-III (Fig. 28) with 2 unguis equal in size and simple. *Wing.* Costa with a small patch of white scales at base; 1, 2 remigial setae; upper calypter with several dark setae on margin. *Abdomen.* Terga II-VII brown scaled with a large laterobasal patch of white scales, II-VII also with a narrow dorsobasal

band of white scales connected with laterobasal patches of white scales, white scaled band on VII broad; sterna II-VII white scaled, III-VII also with a narrow apical band of brown scales, brown scaled band on VII covering apical 0.4. *Genitalia* (Fig. 13). Tergum VIII with scales absent, basal 0.8 retracted into segment VII, base concave mesally, apex straight, numerous short setae scattered over apical 0.94, setae along apex short and thin, basolateral seta absent, VIII-Te index 1.12, VIII-Te/IX-Te index 2.53, length 0.28 mm, width 0.25 mm; sternum VIII with a large lightly pigmented median area, scales absent, base slightly concave mesally, apex with a small median indentation (0.09 of length) and a medium size lobe on each side of midline, short to moderately long setae on apical 0.91, apical intersegmental fold lightly pigmented, VIII-S index 0.98, length 0.32 mm, width 0.33 mm; tergum IX with mesal area lightly pigmented, apex with a small median indentation and with 4-6 setae on each side of midline, 9-11 total setae, IX-Te index 0.97-0.98, length 0.10-0.11 mm, width 0.11 mm; insula with 7 small tuberculi; lower vaginal lip with numerous long spicules scattered over surface, lower vaginal sclerite absent; upper vaginal lip with upper vaginal sclerite moderately pigmented, medium size; postgenital lobe with apex with a moderately deep median indentation (0.22-0.23 of length), 6-9 setae on each side of midline, 13-17 total setae, dorsal PGL index 0.93-0.94, ventral PGL index 1.66-1.73, ventral length 0.11-0.13 mm; cercus with 2, 3 long setae at apex, dorsal surface with a number of short to moderately long setae on apical 0.89-0.91, 1-8 scales, ventral surface with a few short setae on lateral margin, cercus index 3.39-3.48, cercus/dorsal PGL index 3.52-3.71, cercus length 0.22-0.27 mm; one large and 2 medium size seminal capsules, base of accessory gland duct heavily pigmented.

PUPA and LARVA. Not known.

TYPE-DATA. The holotype male, deposited in the BMNH, possesses the following data on the adult labels: S. India, Travancore, M.O.T. Iyengar; Pres. by I. M. Puri, XII. 1936 [Mattingly 1958b: 77, erroneously reported this as Dec. 1935]; Hypopygium on slide; *Aedes (Paraëdes) menoni* Mattingly, HOLOTYPE, P. F. Mattingly, 31: i: 58, Terminalia on slide; and Type [circular label with a red border]. The holotype is in poor condition and is as follows: a minuten pin extends through the mesepisternum of both sides, notum badly rubbed, right antenna missing, right wing partially broken, tarsolete 5 of left foreleg missing, right mid- and hindlegs missing, and abdomen removed and mounted on a slide. The genitalia are mounted in balsam on a microscope slide and are badly damaged. The allotype and 2 female paratypes possess the same label data as the holotype and are in the BMNH. These 3 female specimens are in good condition with the exception of rubbed areas on their thoraces.

DISTRIBUTION. Four specimens examined: 1♂ and 3♀.

INDIA. Travancore, Dec. 1936, M.O.T. Iyengar, holotype 1♂, allotype 1♀, paratypes 2♀.

*Distribution from literature.*

INDIA. Travancore, Southwest India (Mattingly 1958b: 77).

DISCUSSION. The habitus of the adults of *menoni*, especially the scale pattern of the scutum, set this species apart from those of other species of the subgenus as shown in Figure 2.

Female genitalia of *menoni* differ from all other species of the subgenus by the presence of 3 well developed seminal capsules while the others each have a single large one. Other differences of *menoni* are sternum VIII index 0.98, tergum VIII index 1.12, cercus index 3.39-3.48, tergum IX index 0.97-

0.98, and cercus/dorsal PGL index 2.52-3.71. Even though the 3 females (allotype and 2 paratypes) possess the same collection data as the holotype male and share a number of habitus features, the differences in the female genitalia, especially the presence of 3 seminal capsules, suggest that positive association of the sexes of this species needs to be confirmed by progeny reared specimens, both male and female, with associated immature exuviae.

The male genitalia, even though the single specimen is badly damaged, are distinct and easily distinguished by the development of the basal mesal lobe and gonostylus from those of the other species of the subgenus (see Fig. 7).

**BIONOMICS.** Nothing is known about the bionomics or medical importance of this species.

#### *AEDES (PARAEDES) OSTENTATIO (LEICESTER)*

(Figs. 2, 8, 14, 20, 22, 26-28)

*Aioretoomyia Ostentatio* Leicester 1908: 193 (♀).

*Aioretoomyia ostentatio* of Brunetti 1912: 490.

*Ochlerotatus ostentatio* of Edwards 1913: 228 (*in part*); Brunetti 1920: 140 (*in part*); Senior-White 1923: 81 (*in part*).

*Aedes ostentatio* of Edwards 1922a: 263 (key); Stojanovich and Scott 1965: 20 (♀\*, key), 1966: 110 (♀\*, key).

*Aedes (?) ostentatio* of Edwards 1922b: 468 (*in part*); Brug and Bonne-Wepster 1947: 185 (*in part*).

*Aëdes (Aedes) ostentatio* of Edwards 1928: 53, 1929: 3.

*Aedes (? Aedimorphus) ostentatio* of Edwards 1932: 171 (*in part*); Barraud 1934: 267 (♀, *in part*); Macdonald 1957: 21 (*in part*).

*Aëdes ostentatio* of Brug and Edwards 1931: 259.

*Aedes (Aedimorphus) ostentatio* of Bohart 1945: 52, 63 (♀, key, *in part*); Knight and Hull 1953: 463 (♀, *in part*); Horsfall 1955: 518 (*in part*).

*Aëdes (Paraëdes) ostentatio* of Mattingly 1958a: 7, 9, 22, 24, 25 (♀\*, key, *in part*), 1958c: 106 (lectotype designation).

*Aedes (Paraedes) ostentatio* of Stone, Knight and Starcke 1959: 200 (*in part*); Army Mosquito Project 1965: 29 (key); Stone et al. 1966: 50 (key); Basio 1971: 26 (*in part*); Stone and Delfinado 1973: 307 (*in part*); Knight and Stone 1977: 148 (*in part*).

**MALE.** *Head.* Antenna dark brown, 1.17-1.21 length of proboscis, pedicel dark brown with a few short fine brown setae and small dark scales mesally; maxillary palpus 0.09-0.10 length of proboscis; clypeus dark brown; proboscis 0.87-0.97 length of femur I; vertex covered with broad decumbent dark brown scales, a few narrow curved golden-white scales on interocular space, ocular line with narrow curved golden scales; lateral surface covered with broad dark brown scales and with a patch of broad white scales anterior to antepronotum and posterior to eye margin; occiput with a few short erect forked brown scales and a few broad decumbent white scales; interocular and ocular setae dark brown and well developed; eyes slightly separated anteriorly. *Thorax.* Scutal integument dark brown; scutum covered with narrow curved reddish-black scales except for narrow curved golden scales on anterior promontory area and anterior scutal fossal area; scutum with reddish-black setae as follows: 2-4 anterior promontory, numerous dorsocentral (anterior and posterior), scutal fossal (3, 4 anterior, 2, 3 lateral and 1, 2 posterior),

numerous supraalar, 4 short posterior medial scutal; scutellum with a small patch of narrow curved reddish-brown scales on each lobe, 5-8 setae on median lobe, 3-5 setae on each lateral lobe; pleural integument dark brown; antepronotum covered with broad dark brown scales, 7-9 reddish-black setae; postpronotum with narrow curved reddish-black scales along dorsal margin and a small patch of 4-8 broad dark brown scales on posterior area anterior of setae, 3, 4 reddish-black posterior setae; propleuron covered with broad white scales, 5, 6 setae; paratergite bare; postspiracular area with 2, 3 broad white scales (some specimens with scales rubbed off), 3, 4 dark brown setae; mesepisternum with a large patch of broad white scales on upper area and a small patch of similar scales on lower area, 2, 3 setae on upper area and 7-9 setae on posterior area, lower setae short and pale; prealar knob with 6-8 dark brown setae; mesepimeron with a large patch of broad white scales, 8-11 short golden setae dorsad of scales. *Legs.* Coxae I-III with several dark brown setae, I with anterior surface with broad white scales and a small anterior median patch of broad brown scales, II and III with a small anterior patch of broad white scales; trochanters I-III with a few broad pale scales and a few short golden setae; femur I with anterior and posterior surfaces covered with dark brown scales, I also with a posteriodorsal pale stripe from base to near apex, femur II with anterior and posterior surfaces dark brown scaled and a posteroventral longitudinal dusty-white scaled stripe on basal 0.7, stripe broader proximally, femur III dark brown scaled with an anteroventral and a posteroventral longitudinal dusty-white scaled stripe on basal 0.70-0.85, stripe broader proximally; posttarsi I-III (Fig. 27) with 2 unguis, I and II with unques equal in size and with a tooth, III with unguis equal in size, both simple. *Wing.* Dorsal and ventral veins dark brown scaled; costa without a patch of white scales; alula with narrow brown scales along margin; 1, 2 short brown remigial setae; upper calypter bare. *Halter.* Pedicel pale; capitellum dark brown scaled. *Abdomen.* Terga dark brown scaled, II-VII with a small laterobasal patch of white scales; sterna white scaled, III-VII with a narrow apical band of brown scales. *Genitalia* (Fig. 8). Tergum IX strongly bilobed with 2, 3 short setae on each lobe; gonocoxite with an apical sternomesal lobe, tergal surface with 3-5 long stout and 9-12 moderately long setae and one or 2 irregular rows of setae on basal 0.65 of tergomesal margin, setae short distally and increase in length proximally until they become moderately long at base, lateral surface with a few long and moderately long setae, sternal surface with a number of long stout and a few short setae on apical 0.3 and a subapical elongate patch of approximately 20-25 moderately long and a few short setae on mesal margin, lateral surface and lateral areas of tergal and sternal surfaces with scales; gonostylus with pedicel narrow and distal portion bifid and divided into a narrow club-shaped tergal arm bearing 12-15 short setae and a file-like area of spicules, and a flattened rectangular shaped sternal arm with small hair-like spicules on distal 0.55; basal mesal lobe divided at base into 2 long arms, mesal arm with distal 0.5 narrower, curved tergally and with 3 moderately long hook-like setae at apex, proximal 0.5 somewhat flattened, expanded distally, and covered with short hair-like spicules, outer arm long, middle of length somewhat swollen, distal 0.25 narrower and covered with short to long simple spines, similar short spines near middle of length, becoming more numerous distally, basal 0.3 cylindrical and with a short finger-like projection near base which bears 2, 3 short setae, one apically and one or 2 subapically; phallosome with aedeagus divided into 2 heavily pigmented lateral plates connected basally, each plate with one or 2 stout teeth, apical 0.3 with a lightly pigmented sternal connection, distal portion of

each plate bluntly rounded with apex pointed and projected mesally, paramere approximately 0.88 length of lateral plate, parameral apodeme moderately long and narrow; sternum IX large, with 2, 3 long stout setae near center.

**FEMALE.** The female differs markedly from the male in the scale patterns of the head, thorax and legs and the number of thoracic setae. The following features differ from the male. *Head.* Antenna 1.27-1.35 length of proboscis; maxillary palpus 0.18-0.19 length of proboscis; proboscis 0.91-0.99 length of femur I; vertex covered with broad decumbent dark blackish-brown scales and a median triangular patch of narrow curved golden scales, numerous erect forked golden scales scattered throughout golden scale patch from occiput to interocular setae; interocular setae golden, well developed. *Thorax* (Fig. 2). Scutum covered with narrow curved reddish-black scales, narrow curved golden scales on following: anterior promontory area, extending from anterior scutal fossal area over lateral scutal fossal area to scutal angle, a few on scutal ridge, a broad stripe on acrostichal area extending from anterior promontory area over posterior medial scutal area and along lateral margins of prescutellar bare space, a more or less distinct narrow stripe on anterior dorsocentral area to approximately scutal ridge, and a small patch on supraalar area cephalad of wing base; scutellum with curved golden scales on all lobes; setal differences are as follows: 3-5 anterior scutal fossal, 2-4 lateral scutal fossal, 6 posterior medial scutal, scutellum with 6-9 on median lobe and 4-7 on lateral lobe, 8-11 antepronotal, 3-5 postpronotal, 6-8 propleural, 2-5 postspiracular, 1-3 upper and 7-14 posterior mesepisternal, 7-10 on prealar knob, and 10-13 mesepimeral; postspiracular area with a patch of broad white scales. *Legs.* Femora I-III with a small dorsoapical patch of white scales; posttarsi I-III (Fig. 28) with 2 unguis, I and II with unguis equal in size and with a tooth, III with unguis equal in size, both simple. *Wing.* Upper calypter with dark setae on margin. *Halter.* Capitellum with dark scales at base and white scales apically. *Abdomen.* Tergum VIII with a laterobasal pale scaled patch. *Genitalia* (Fig. 14). Tergum VIII with scales absent, basal 0.85-0.95 retracted into segment VII, base concave mesally, apex straight, numerous short setae scattered over apical 0.68-0.77, setae along apex short and thin, basolateral seta absent, VIII-Te index 0.68-0.79, VIII-Te/IX-Te index 2.02-2.30, length 0.19-0.22 mm, width 0.25-0.30 mm; sternum VIII with scales absent, base concave mesally, apex with a moderately deep median indentation (0.13-0.16 of length) and a small lobe on each side of midline, short to moderately long setae on apical 0.82-0.95, seta 2-S approximately 0.38 from 1-S, seta 3-S approximately 0.62 from 2-S, apical intersegmental fold lightly pigmented, VIII-S index 0.59-0.65, length 0.20-0.22 mm, width 0.35-0.40 mm; tergum IX with apex with a small median indentation and with 2-5 (usually 3, 4) short thin setae on each side of midline, 5-9 total setae, IX-Te index 0.67-0.75, length 0.09-0.10 mm, width 0.12-0.14 mm; insula with 4-6 small tuberculi; lower vaginal lip with numerous minute to short spicules scattered over entire surface, lower vaginal sclerite absent; upper vaginal lip with upper vaginal sclerite moderately to heavily pigmented, large size; postgenital lobe with a very small to moderately deep median indentation (0.03-0.25 of length), 7-10 (usually 7, 8) setae on each side of midline, 14-17 total setae, dorsal PGL index 0.94-1.03, ventral PGL index 1.43-1.61, ventral length 0.10-0.12 mm; cercus with 2 long stout setae at apex, dorsal surface with a number of short to moderately long setae on apical 0.73-0.79, 0-4 broad scales (usually 1, 2 scales), ventral surface with a few short setae on lateral margin, cercus index 2.20-2.58, cercus/dorsal PGL index 2.41-2.68, cercus length 0.17-0.19 mm; one large seminal

capsule, accessory gland duct moderately to heavily pigmented.

PUPA (Figs. 20, 22). Chaetotaxy as figured and recorded (Table 4). *Cephalothorax*. Seta 1-CT with 2-7 branched; 5-CT with 3-8 branches.

*Respiratory trumpet*. Index 4.94-5.73, mean 5.28. *Abdomen*. Seta 4-I usually 7-10(6-10) branched; 5-I usually 4, 5(3-6) branched; 1-II with 8-19 branches; 2-II inserted mesad of 3-II; 10-III usually single or 2(1-3) branched; 7-IV with 2-4 branches; 10-IV usually 2 (2-4) branched; 1-V with 2-5 branches; 6-VI single. *Paddle*. With minute spicules on apical 0.42-0.54 of lateral and apical 0.12-0.18 of mesal margins; index 1.42-1.76, mean 1.56.

LARVA (Fig. 26). Description based on 4 larval exuviae with associated adults. *Head*. Moderately pigmented; setae 0, 1, 3, 14, 18, 20-C single; 4-C with 8-12 (8) branches, short; 5-C with 6-8 (7) branches, very long; 6-C with 5, 6 (5) branches, very long; 7-C with 10-14 (13) branches, long; 8-C with 2, 3 (2) branches; 9-C with 3-5 (4) branches; 10-C with 2-4 (2) branches; 11-C with 4-6 (5) branches; 12-C with 6-8 (8) branches; 13-C with 5-8 (6) branches; 15-C with 3-5 (4) branches; dorsomentum with 30-32 (30) teeth, heavily pigmented. *Antenna*. Scape long, index 11.75-12.50, mean 12.08; seta 1-A with 4, 5 (4) branches, inserted 0.51-0.53 from base. *Thorax*. Seta 0-P with 9-16 (11) branches; 1, 5, 6, 10, 12-P single; 2, 9-P single to 3 (2) branched; 3-P with 3-5 (4) branches; 4-P with 2-4 (3) branches; 7-P with 3, 4 (3) branches; 8-P single or 2 (1) branched; 11-P with 2-5 (4) branches; 12-P with 2, 3 (2) branches; 1-M with 2-5 (4) branches; 2-M with 3-5 (4) branches; 3, 5, 7, 10, 12-M single; 4-M with 2-6 (5) branches; 6-M with 5, 6 (6) branches; 8-M with 7-9 (7) branches; 9-M with 6-8 (8) branches; 11-M single or 2 (1) branched; 13-M with 19-26 (24) branches; 14-M with 11-16 (16) branches; 1-T single to 3 (2) branched; 2-T with 4-6 (4) branches; 3-T with 10-14 (12) branches; 4-T with 4-6 (5) branches; 5, 10, 11-T single; 6-T with 2, 3 (2) branches; 7-T with 9-12 (10) branches; 8-T with 7-11 (11) branches; 9-T with 3, 4 (3) branches; 12-T single or 2 (1) branched; 13-T with 11-20 (15) branches. *Abdomen*. Setae 0, 2, 13-I single; 1-I with 4-9 (7) branches; 3-I with 3-7 (5) branches; 4-I with 17-20 (19) branches; 5-I with 4-8 (6) branches; 6, 9-I with 2, 3 (2) branches; 7, 11-I single or 2 (2) branched; 9, 10-I with 2, 3 (2) branches; 0, 2, 9, 10, 14-II single; 1-II with 2-4 (3) branches; 3-II with 5, 6 (5) branches; 4-II with 10-15 (11) branches; 5-II single to 4 (2) branched; 6-II with 2, 3 (2) branches; 7-II with 3-7 (6) branches; 8-II with 2-4 (3) branches; 11-II with 3, 4 (4) branches; 12-II with 3, 4 (3) branches; 13-II with 12-20 (16) branches; 0, 2, 6, 9, 14-III single; 1-III with 6-8 (8) branches; 3-III with 3-5 (4) branches; 4-III with 2-4 (3) branches; 5, 10, 11-III with 2, 3 (2) branches; 7-III with 8-12 (9) branches; 8-III single or 2 (2) branched; 12-III with 2-4 (4) branches; 13-III with 4-7 (5) branches; 0, 2, 6, 9, 14-IV single; 1-IV with 5-7 (6) branches; 3-IV with 4, 5 (4) branches; 4, 12-IV with 2, 3 (2) branches; 5, 8-IV with 2, 3 (2) branches; 7-IV with 8-10 (10) branches; 10-IV single to 3 (2) branched; 11-IV with 2, 3 (3) branches; 13-IV with 4 branches; 0, 2, 6, 9, 14-V single; 1-V with 4-6 (6) branches; 3-V with 3 branches; 4-V with 7-10 (10) branches; 5-V with 2-5 (3) branches; 7-V with 6-9 (6) branches; 8, 11-V with 2, 3 (3) branches; 10, 12-V with 2, 3 (2) branches; 13-V with 4 branches; 0, 2, 6, 9, 10, 14-VI single; 1-VI with 5-7 (6) branches; 3, 7-VI with 3-5 (3) branches; 4, 8-VI with 4, 5 (4) branches; 5-VI with 2-5 (5) branches; 11-VI with 2-4 (2) branches; 12-VI with 2, 3 (3) branches; 13-VI with 10-26 (18) branches; 0, 14-VII single; 1-VII with 6-8 branches; 2-VII single or 2 (1) branched; 3-VII with 6, 7 (6) branches; 4-VII with 3, 4 (3) branches; 5-VII with 4-8 branches; 6-VII with 15-17 (17) branches; 7-VII with 2, 3 (2) branches; 8-VII with 10-13 branches; 9-VII with 2-4 (4) branches; 10-VII with 2, 3 (3) branches; 11-VII

with 3 branches; 12-VII with 2, 3 branches; 13-VII with 7-10 branches; 0, 4, 14-VIII single; 1-VIII with 4-6 (4) branches; 2-VIII with 2, 3 (2) branches; 3-VIII with 7-9 (8) branches; 5-VIII with 7-10 (7) branches; comb on VIII with 9-12 (usually 9-11) scales; 1-X with 2, 3 (2) branches; 2-X with 10-13 (13) branches, moderately long; 3-X single, long; 4-X with 9, 10 setae on grid, each with 5-20 branches and one short precratal seta. *Siphon*. Heavily pigmented, apical 0.4 very heavily pigmented, dark brownish-black colored; index 3.33-3.56, mean 3.43; pecten on basal 0.40-0.45, with 13-16 (usually 13, 14) teeth, each tooth with one or 2 small ventral denticles near base, apex long, narrow and pointed, distal 1-3 teeth spine-like, without denticles and wider spaced than remainder; 1-S with 2-4 (4) branches, inserted on basal 0.61-0.63 of siphon and distad of last pecten tooth; 2-S single, short; 6, 7, 9-S single; 8-S with 2, 3 (2) branches.

**TYPE-DATA.** Leicester (1908: 194) stated that *Aioreomyia Ostentatio* was described from a series of females hatched from larvae found in a small jungle pool and some collected as adults. Mattingly (1958c: 106) reported that Leicester's type-series is now represented by only 2 female cotypes which are deposited in the BMNH. He designated one as lectotype and it contains the following data: *Aedes (Paraedes) ostentatio* Leicester, HOLOLECTOTYPE, P. F. Mattingly 1958; Patch of jungle, 4 1/2 miles, Pahang Rd., Kuala Lumpur, 21/9/03; Cotype; Kuala Lumpur, Fed. Malay States, Dr. G. F. Leicester, 1912-350; and *Aioreomyia ostentatio* Leic. The other female, which is incomplete and in poor condition, was designated as a paratype by Mattingly (1958c: 106) and bears the following data: Jungle, 5th mile, Gombak Rd., 5/2/04; and other data as in lectotype.

**DISTRIBUTION.** Ninety-nine specimens examined: 2 ♂pl, 2 ♂, 7 ♀pl, 5 ♀p, 59 ♀ and 1 L.

**INDONESIA.** Celebes, Paloe, 2 Aug. 1935, 35.825, 1♀. Java, Tasikmala-ja, Padaherang, 14.339, 3♀. Sumatra, vicinity of Bengkula, 2 Jan. 1958, C. Soegiarto, 1♀; same except 30 June 1958, 1♀; same except 7 July 1958, 2♀.

**MALAYSIA.** Pahang, Kg. Lamir, Pakan, 5 Apr. 1954, R. H. Wharton, 1♀. Sabah, Tenom, 9 Apr. 1970, S-440, S. bin Omar, C. Y. Wang and Ho, 2♀; North Borneo, Kalabakan, 1962, Bishop, 1♀. Sarawak, Kuching, 3rd mile Rook Rd., 27 Jul. 1914, J. C. Moulton, 1♀; Tarakan, 9 Jun. 1945, A. G. Humes, 1♀. Selangor, Puchong Rd., May 1956, 0.27, 1♀; Puchong Rd., 14 miles, 3 Jun. 1959, 01239/1, /2, /8, /9, 2 ♂pl and 2 ♀pl.

**REPUBLIC OF THE PHILIPPINES.** Luzon Island, Mountain, Calaccad, Stations 13 and 15, 25 Jun. and 9 Jul. 1963, L. E. Rozeboom and B. D. Cabrera, 2♀. Palawan Island, Quezon, approximately 10 miles south of Quezon, 1964, No. 39, L. E. Rozeboom and B. D. Cabrera, 1♀; same except No. 64, 14♀.

**THAILAND.** Chon Buri, Amphoe Bang La Mung, Khao Mai Keo, 7-8 Oct. 1963, CL-1, CL 14-19, K. Mongkolpanya and team, 1 ♀pl and 2♀; same except 21, 22, 27 Aug. 1963, U-614, -616, -617, -618, -631, Udaya Sandhinand and team, 21♀; Khao Mai Ha Wa, 1 Jul. 1965, 00247-12, -100, -105, E. L. Peyton and team, 1 ♀pl and 2 ♀p; same except 30 Jun. 1965, 00242-101, 1 ♀p, 00248-10, 1 ♀pl. Khon Kaen, Amphoe Chumphae, Pha Dong Larn, 30 Nov. 1962, T-1857, S. Esah, 1♀; same except Tham Pho Thi Yan, 16 Nov. 1962, T-1853, -1854, 2♀. Nakhon Ratchasima, between Kabinburi and Pak Tong Chi, 24 May 1967, 02029, -100, K. Mongkolpanya, 1 ♀pl and 1 L. Nakhon Sawan, Ban Kaeng, 9 Nov. 1968, 03128, K. Mongkolpanya and team, 1♀. Prachin Buri, Ban Tub Lan, 20 Jul. 1971, P3-103, K. Mongkolpanya and team, 1 ♀p; same except 06031-100, 1 ♂; same except 11 Aug. 1971, P 14, P 14-1, -100, 1 ♂,

1 ♀pl and 1 ♂p.

*Distribution from literature.*

INDONESIA. Sumatra, Moeara Tebo (Haga 1924: 831), Sumatra, Benkoelem, Air Priokan (Brug and Edwards 1931: 259), Dermajoe, Java, Tasikmalaja, Padaherang (Mattingly 1958a: 26, questions the records from Ceram and Indochina); Ceram, Java, Sumatra (Brug and Bonne-Wepster 1947: 185).

MALAYSIA (Edwards 1928: 53; Bohart 1945: 63; Brug and Bonne-Wepster 1947: 185); Sarawak (Moulton 1914: 47); Kuala Lumpur, Phang Rd. 4.5 miles (Mattingly 1958c: 106); Pahang, near Kuantan (Macdonald 1957: 21); Tregganu, Ulu Trengganu (Ramachandran et al. 1970: 511); Sarawak, Kampong Pangkalan Kuap, Rajah Charles Brooke Memorial Hospital, 18 km south of Kuching on Penrissen Rd. (Macdonald, Smith and Webb 1965: 338); Tarakan, Sarawak, Rantau Panjang, Selangor (Mattingly 1958a: 26); Selangor, Rantau Panjang (Ann. Rep. Inst. Med. Res. for 1956, 1968, Fed. Malaya, 1957: 107, 1968: 63); Telok Forest Reserve (Unif. Calif. Internat. Center Med. Res. Ann. Prog. Rep. for 1973, 1973: 24); Sintok, Pacific Tin (Ann. Rep. Inst. Med. Res. for 1964, Malaysia, 1968: 27, 31); Perak, Parit, Mukim Kampong Gajah (Ann. Rep. Inst. Med. Res. for 1965, Malaysia, 1968: 32).

REPUBLIC OF THE PHILIPPINES (Edwards 1929: 3; Bohart 1945: 63; Brug and Bonne-Wepster 1947: 185; Delfinado, Viado and Coronel 1962 (1963): 440); Palawan, Bacungan, Mindoro, San Jose (Knight and Hull 1953: 464); Palawan, Quezon Province, about 10 miles south of Quezon (Rozeboom and Cabrera 1965: 208); Luzon, Mt. Makiling (Basio, White and Reisen 1970: 442); Laguna, Los Banos (Basio 1971: 26).

THAILAND. Nakhon Phanom, Takhlai, U-Tapao (Parrish 1968b: 7, 10, 13), Ubon, Udorn (Reisen, Burns and Basio 1971, tables 4-8, 12, 13; Biery and Burns 1973: 20, 24, 27, 30, 33); Udorn (Biery and Burns 1972: 18); Prachinburi, Bu Phram Valley (Wilkinson et al. 1978: 669).

VIETNAM (Brug and Bonne-Wepster 1947: 185); Pleiku, Phu Cat (Parrish 1968a: 18, 20; 1969: 554); Cam Ranh Bay, Phu Cat (Reisen, Burns and Basio 1971, tables 12, 13; Biery and Basio 1973: 7, 15).

DISCUSSION. Adults of *ostentatio* are similar in habitus to those of *chrysoscuta*, therefore, for a comparison of the adults of these 2 species see the discussion section of the latter species. The pale scaled patterns of the head and scutum of the sexes are dimorphic for *ostentatio*. The patterns also display variation between specimens from the same collection. *Aedes ostentatio* adults are easily identified by the antepronotum which has both broad dark and pale scales, the scutellum which has narrow curved golden scales on all 3 lobes, and the paratergite which is without scales.

Male genitalia of *ostentatio* are similar to those of *chrysoscuta* and are discussed under the latter species. The development of the basal mesal lobe is somewhat variable in the shape and number of spines on the one arm, however, the spines are simple and the arm is swollen.

The female genitalia of *ostentatio* are most similar to those of *chrysoscuta* but can be separated by several features (see discussion section for *chrysoscuta*).

*Aedes ostentatio* pupae have the genital lobe shaped similarly to those of *chrysoscuta* and *thailandensis* (see Figs. 18, 22). The length of seta 5-IV, V, VI is less than 1.50 length of the attached segment which is similar to *bonneae*, but differs from *collessi* in which it is less than 1.25 and from *thailandensis* in which it is greater than 1.50. *Aedes ostentatio* pupae are very similar to those of *chrysoscuta*, however, they can usually be separated by the characters mentioned in the key.

Larvae of *ostentatio* are also similar to those of *chrysoscuta* and a comparison is given under the discussion section of the latter. The above description of the larva of *ostentatio* is taken from Malaysian specimens since it is the type-locality. Specimens from Thailand share most characters with those from Malaysia, however, several features differ between the 2 populations and these follow (Malaysia listed first and Thailand in parentheses); seta 7-T with 8-12 (7, 8) branches; 3-VIII with 7-9 (3-5) branches; 2-X with 10-13 (6-8) branches; and siphon index 3.33-3.56 (2.30-2.91). Unfortunately, very limited material was available from both these locations.

Larvae of *ostentatio* are easily separated from *collessi* and *thailandensis* by the apical 0.4 of the siphon being very heavily pigmented. *Aedes ostentatio* larvae are also distinguished from those of *bonneae* by the siphon pigmentation which is very heavy and brownish-black in *ostentatio* but paler and brown in *bonneae*.

**BIONOMICS.** In Malaysia females were taken once biting man in partial shade of a secondary rain forest in hilly terrain. In Thailand adults have been collected as follows: resting in a bamboo grove at the margin of a stream (once); biting man in a plantation near a village in partial shade from 0600-0900 h (once); biting man in sparse vegetation of a forest (once); biting man outside from 1100-1200 h (twice) and 2200-2300 h (once); and during the daytime (twice).

In Thailand larvae were taken twice from fresh water in a large footprint of an elephant in partial shade of secondary scrub in a valley at 150 m elevation; from small crab holes in heavy shade of a secondary rain forest (twice) and a tapioca plantation (once) in mountain terrain and at 150 m elevation; and once from a small deep hole near a stream. Adults have been taken during the months of May through August, October and November while immatures were collected in May through August and October.

Leicester (1908: 194) stated the adults of *ostentatio* are sylvan and vicious day biters in Malaysia. Also in Malaysia, Macdonald (1957: 21) reports the adults occasionally were taken on human bait and Macdonald, Smith and Webb (1965: 342) record this species taken biting in small numbers by day or in the early evening. Ramachandran et al. (1970: 511) indicate *ostentatio* adults made up 5 percent of all *Aedes* collected during 19 nights of human bait trap and human bare leg catches in Tregganu, Malaysia, and when they were examined for *Brugia malayi* they were negative. In Malaysia, *ostentatio* adults were collected from Kera and human baited traps (Ann. Rep. Inst. Med. Res. for 1963, Fed. Malaya, 1968: 53) and from traps baited with either monkeys or humans, examined and found negative for filaria parasites (Ann. Rep. Inst. Med. Res. for 1965, Malaysia, 1968: 23). In Selangor, Malaysia, *ostentatio* was reported to be the sixth most prevalent mosquito species that attacked man in nipah palm mangrove swamps (Ann. Rep. Inst. Med. Res. for 1956, Fed. Malaya, 1957: 107).

In the Philippine Islands adults were: netted in a densely shaded area near a river (Knight and Hull 1953: 464); collected from undergrowth nearby a larval breeding place and were a vicious daytime biter (Basio, White and Reisen 1970: 443). Rozeboom and Cabrera (1965: 208) reported that of 21 *ostentatio* collected in the Philippine Islands from human baited traps in a swamp-forest environment, 4 were dissected and found negative for *Brugia malayi* parasites.

In Vietnam adults were collected in light traps from May through August (Reisen, Burns and Basio 1971: tables 12, 13; Biery and Basio 1973: 7, 15). Stojanovich and Scott (1965: 32; 1966: 136) report this species to be a vicious

daytime biter of man in densely shaded areas near rivers in this country.

This species has been taken in New Jersey light traps in Thailand during the months of March, April, June, July and October (Reisen, Burns and Basio: tables 4-8; Biery and Burns 1972: 18; Biery and Basio 1973: 7, 15).

Wilkinson et al. (1978: 669) in Thailand collected moist soil samples from the bottoms and margins of former pools and flooded these in the laboratory; larvae of *Ae. ostentatio* were produced from these samples.

*AEDES (PARAEDES) PAGEI (LUDLOW)*

(Figs. 2, 15, 28)

*Danielsia pagei* Ludlow 1911: 128 (♀); of Stone and Knight 1956: 233.

*Aedes (?) ostentatio* of Edwards 1922b: 468 (*in part*).

*Aëdes (Aëdes) ostentatio* of Dyar and Shannon 1925: 78.

*Aedes (Aedimorphus) ostentatio* of Bohart 1945: 63 (*in part*); Knight and Hull 1953: 463 (*in part*).

*Aëdes (Paraëdes) pagei* of Mattingly 1958a: 21, 24, 31 (♀\*, key).

*Aedes (Paraedes) pagei* of Stone, Knight and Starcke 1959: 200; Stone and Delfinado 1973: 307; Knight and Stone 1977: 148.

MALE. Not known.

FEMALE. Head. Antenna dark brown, 1.18-1.34 length of proboscis, pedicel golden-brown with a few small broad brown scales and several short fine brown setae mesally, flagellomere 1 with a few small broad brown scales on basal 0.5; maxillary palpus 0.17-0.20 length of proboscis; clypeus dark brown; proboscis 0.97-1.05 length of femur I; vertex covered with broad decumbent dark brown scales and a triangular patch of narrow curved golden scales on median posterior area (size of patch small to moderate), erect forked golden and a few brown scales in triangular patch; ocular line and interocular space with narrow curved golden scales; lateral surface covered with broad dark brown scales and with a small patch of broad white scales anterior to antepronotum and posterior to eye margin; occiput with numerous erect forked dark brown scales (some specimens also with some golden scales on median area); interocular and ocular setae dark brown and well developed; eyes separated anteriorly. Thorax (Fig. 2). Scutal integument dark reddish-brown; scutum covered with narrow curved dark reddish-brown scales and narrow curved golden scales forming patterns (golden scaled patterns variable) as follows: a patch on anterior promontory area, a narrow stripe on acrostichal area from anterior promontory area to prescutellar bare space at which it forks to form a narrow line along lateral margins, stripe broader on posterior median scutal area, a small patch on anterior scutal fossal area and similar scales extending laterally over lateral scutal fossal area to scutal angle and mesad along scutal ridge, scales forming an indistinct narrow stripe on dorsocentral area (usually a short patch on anterior area and another connected to posterior portion of scutal ridge), small to medium size patch on supraalar area; scutum with dark setae on following areas: 2, 3 anterior promontory, numerous dorsocentral (anterior and posterior), scutal fossal (2-4 anterior, 1-3 lateral and 0-1 posterior), numerous supraalar, 6 posterior medial scutal; scutellum with a patch of narrow curved scales on each lobe, median lobe with golden scales on posterior and lateral areas and reddish-brown scales (absent to numerous) on median basal area, lateral lobe with golden scales (several specimens also with a few reddish-

brown scales); 5-7 setae on median lobe and 4, 5 setae on lateral lobe; pleural integument dark reddish-brown; antepronotum with a patch of narrow curved scales, dark reddish-brown scales on inner area and golden scales on outer area, 7-12 dark setae; postpronotum with narrow curved reddish-brown scales on dorsal and posterior areas, 3, 4 dark posterior setae; propleuron with a patch of broad white scales, 4-6 setae; paratergite with a patch of narrow curved golden scales; postspiracular area with a small patch of moderately broad or broad white scales posterior to setae, 2, 3 dark setae; mesepisternum with a large patch of broad white scales on upper area and a small patch of similar scales on lower area, 1-3 dark setae on upper area and 8-13 setae on posterior area, lower setae short and pale; prealar knob with 4-7 dark setae; mesepimeron with a large patch of broad white scales, 7-11 short setae dorsad of scales. *Legs.* Coxae I-III with several setae, I with anterior surface covered with broad scales, brown scales on lower 0.6 and white scales on dorsal area, II and III with a patch of white scales on anterior area; trochanters I-III with broad brown and white scales; femora I and II with anterior surface dark brown scaled, III with anterior surface brown scaled with a broad pale scaled stripe on ventrobasal 0.65, I-III with posterior surface brown scaled and with a broad white scaled stripe from base to near apex, stripe dorsal on I and ventral on II and III, II and III also with a small apical white scaled patch on anterior and posterior surfaces, I occasionally with similar pale scaled patches; posttarsi I-III (Fig. 28) with 2 unges equal in size and with a tooth. *Wing.* Dorsal and ventral veins dark brown scaled; costa without a patch of white scales; alula with narrow dark brown scales on margin; one dark remigial seta; upper calypter with a number of narrow dark setae on margin. *Halter.* Pedicel pale; capitellum dark brown scaled. *Abdomen.* Terga I-VII dark brown scaled and with a large patch of white scales on laterobasal area; sterna II-VII with basal area white scaled and posterior area brown scaled. *Genitalia* (Fig. 15). Tergum VIII with scales absent, basal 0.70-0.85 retracted into segment VII, base concave mesally, apex straight, numerous short setae scattered over apical 0.70-0.81, setae along apex short and thin with the exception of 2, 3 moderately long thin ones, basolateral seta minute, VIII-Te index 0.63-0.73, VIII-Te/IX-Te index 2.22-2.49, length 0.19-0.20 mm, width 0.26-0.29 mm; sternum VIII with 0-4 broad scales (usually absent), base concave mesally, apex with a moderately deep median indentation (0.11-0.14 of length) and with a small lobe on each side of midline, short to moderately long setae on apical 0.82-0.92, seta 2-S approximately 0.48 from 1-S, seta 3-S approximately 0.52 from 2-S, apical intersegmental fold lightly pigmented, VIII-S index 0.61-0.71, length 0.21-0.22 mm, width 0.30-0.34 mm; tergum IX with apex with a moderately deep median indentation and with 3-5 (usually 4) thin setae on each side of midline, 7-9 total setae, IX-Te index 0.67-0.82, length 0.08 mm, width 0.10-0.12 mm; insula with 4, 5 small tuberculi; lower vaginal lip with numerous long spicules scattered over entire surface, lower vaginal sclerite absent; upper vaginal lip with upper vaginal sclerite moderately pigmented, medium to large size; postgenital lobe with apex with a moderately deep median indentation (0.11-0.25 of length), 7-10 (usually 7, 8) setae on each side of midline, 15-19 total setae, dorsal PGL index 0.85-0.94, ventral PGL index 1.20-1.48, ventral length 0.09 mm; cercus with apex sharply rounded with 2 long stout setae, dorsal surface with a number of short to moderately long setae on apical 0.77-0.91, scales absent, ventral surface with a few short setae on lateral margin, cercus index 2.15-2.50, cercus/dorsal PGL index 2.5-2.8, cercus length 0.15-0.17 mm; one large seminal capsule, base of accessory gland duct heavily pigmented.

PUPA and LARVA. Not known.

TYPE-DATA. The lectotype female, deposited in the U. S. National Museum of Natural History (USNM), possesses the following data on the adult labels: Fort Pickit [Malabang, Lanao], Mindanao, P. I. [Philippine Islands]; *Danielsia pagei* Ludl., Lectotype, Knight and Hull 1953; and Type No. 27799 U. S. N. M. [red rectangular label]. The lectotype is in good condition, but it has the left and most of the right antennae missing, and tarsomeres 1-5 of left midleg and tarsomeres 2-5 of left hindleg missing. Knight and Hull (1953: 463) designated one of the 7 cotypes of *pagei* as lectotype. Ludlow (1911: 128) indicated that *pagei* was described from 7 specimens which were collected in November at 0600 h by Major Henry Page, U. S. Army. Six female paratypes of *pagei* are in the USNM and possess the same collection data as the lectotype except one specimen which has a handwritten, folded label with the following information: cotype, Mind. [Mindanao], Fort Pikit, *Danilsia Pagei* n. sp. Lud. [Ludlow]. These paratypes are in fair to poor condition.

DISTRIBUTION. Seventy-six specimens examined: 76♀.

INDONESIA. Sulawesi (Central), Kulunera, 4-6 Dec. 1965, R. Straatman, 1♀.

REPUBLIC OF THE PHILIPPINES. Leyte, Tacloban, Diit R., 23 Sept. 1945, H. R. Roberts, 1♀. Mindanao, Malabang, Lanao, Fort Pikit (lectotype, 6 paratypes, 4 others), Henry Page, 11♀; Agusan, S. Francisco 10 Km. SE, 12 Nov. 1959, L. W. Quate, 27♀. Mindoro, San Jose, 21 Jan. 1945, E. S. Ross, 1♀; same except 30 Jan. 1945, 19♀; same except 28 Feb. 1945, 15♀; same except 9 Mar. 1945, Sgt. Spry, 1♀.

*Distribution from literature.*

REPUBLIC OF THE PHILIPPINES (Delfinado, Viado and Coronel 1962 (1963): 440); Mindanao, Fort Pikit (Ludlow 1911: 128).

DISCUSSION. Females of *pagei* are similar to those of *collessi* and *menoni* and share somewhat similar markings of the scutum (see Fig. 2), femora with white scaled apical patches, and eyes separated in front. *Aedes pagei* adults are separated from these 2 species by possessing narrow curved scales on the paratergite and wing with base of costa completely brown scaled. The female genitalia of *pagei* have a single seminal capsule while those of *menoni* have 3.

BIONOMICS. In the Philippine Islands females have been collected in a forest and biting man in a jungle during the months of January through March, September and November. In Indonesia an adult was collected in a Malaise trap during December.

Ludlow (1911: 128) reported adults collected at 0600 h during November in the Philippine Islands.

#### *AEDES (PARAEDES) THAILANDENSIS REINERT*

(Figs. 2, 9, 16, 21-23, 27, 28)

*Aedes (Paraedes) thailandensis* Reinert 1976b: 319 (♀\*, ♂\*, P\*, L\*); Knight 1978: 30.

MALE. Head. Antenna brown, 1.09-1.16 length of proboscis, pedicel dark brown with a few short fine setae and small dark scales mesally; 0.11-0.12 length of proboscis; clypeus dark brown; proboscis 1.07-1.14 length of femur I; several dark brown ocular setae, median 2 longer; vertex with broad

decumbent dark brown scales and a few broad white ones intermixed, a few narrow curved scales on median anterior area and on ocular line, also a few long erect forked pale scales on median area, lateral surface covered with broad dark brown scales except for a large patch of broad white scales on area anterior to antepronotum, a few similar scales on postgena; occiput with narrow curved decumbent creamy-white scales and a number of long erect forked scales, median ones creamy-white and lateral ones dark brown; eyes contiguous anteriorly. *Thorax.* Scutal integument dark reddish-brown; scutum covered with narrow curved dark reddish-brown scales except for narrow curved creamy-white scales on following areas: anterior promontory, scutal fossal area (on anterior and along margin over lateral area to scutal angle), along scutal ridge, a few on anterior dorsocentral area, several on supraalar area, and a stripe of golden-brown narrow curved scales on acrostichal area from anterior to posterior; scutum with dark brown setae as follows: 4, 5 median anterior promontory, numerous dorsocentral (anterior and posterior), scutal fossal (3-5 anterior and 2-4 lateral), numerous supraalar, 4-6 posterior medial scutal; scutellum with narrow curved creamy-white scales on each lobe, median lobe also with a few broader pale brown ones at base, 4, 5 long and 3-6 short setae on median lobe, 2-4 long and 2, 3 short setae on lateral lobe; pleural integument dark brown; antepronotum covered with white scales, broad ones on anterior area and narrow curved ones on posterior area, 8-14 dark setae; postpronotum with narrow curved reddish-brown scales on dorsal area, narrow curved white scales on median area and broad white scales on posterior and lower areas, 4-7 dark posterior setae; propleuron with broad white scales, 14-22 white and brown setae; postspiracular area with a patch of broad white scales, 2-4 brown setae; paratergite with numerous narrow white scales; mesepisternum with a large upper and small lower patch of broad white scales, 3, 4 upper and 10-15 posterior pale brown setae, lower setae shorter; prealar knob with 6-12 golden-brown setae; mesepimeron with a large patch of broad white scales on upper anterior area, 8-12 golden setae dorsad of scales. *Legs.* Coxae I-III with golden to pale brown setae, I with broad white and a small median patch of broad brown scales on anterior surface, II and III with a small patch of broad white scales on lateral surface; trochanters I-III with a small patch of broad white scales and a few short setae; femora I-III with anterior surface dark brown scaled, I also with a narrow dorsal pale scaled stripe on basal 0.6-0.7, II also with a broad ventral pale scaled stripe on basal 0.75-0.85, III also with a broad ventral white scaled stripe on basal 0.8-0.9, stripe narrower distally, I-III with posterior surface dark brown scaled with a well developed white scaled stripe from base to apex, stripe dorsal on I, ventral on II and III; posttarsi I-III (Fig. 27) with 2 unguis, I and II with unguis unequal in size, larger one simple and smaller one with a tooth, III with unguis equal in size, both simple. *Wing.* Dorsal and ventral veins dark brown scaled except for 2-4 white scales at base of costa and 2-5 white scales dorsally and ventrally at base of radius next to remigium; alula with several narrow brown scales on margin; one remigial seta; upper calypter with a row of pale setae on margin. *Halter.* Pedicel pale; capitellum brown scaled with a few pale scales dorsally. *Abdomen.* Terga II-VIII with dark brown scales and a large laterobasal patch of white scales, white patches longer on V-VII and extending slightly onto dorsal surface, VIII also with a broad basal band of white scales which connects with laterobasal white scaled patch, tergum VIII with apex broadly concave with numerous moderately long thin setae forming a dense patch, a number of long stout setae basad of apical patch, mesal ones stouter; sternum white scaled, V-VII also with a narrow pos-

terior band of dark brown scales, bands broader on lateral areas, VIII dark brown scaled with a few white scales on laterobasal area, sternum VIII with apex broadly concave with several moderately long and a few long thin setae on margin. *Genitalia* (Fig. 9). Tergum IX heavily pigmented, bilobed, with 3-6 short thin setae on each lobe, cephalic margin deeply emarginate, lateral margins narrowly connected to sternum IX; gonocoxite heavily pigmented, tergal surface with an elongated patch of short fine setae extending from near base to near apex on mesal area and with a number of very long stout setae along lateral margin and lateral surface, sternal surface with mesal margin somewhat flared and with an elongated patch of very long stout setae from near base to apex, a few basomesal setae short, long thin setae scattered over remainder of sternal surface, numerous broad scales on sternal and lateral surfaces, tergal, sternal and lateral surfaces covered with minute spicules; gonostylus moderately long, approximately 0.77 length of gonocoxite, bifid, inner arm thumb-like with 9-15 very short setae scattered over dorsal surface, ventral surface with a row of 5-7 very short setae and apical area with short spicules forming file-like ridges, outer arm with basal area narrow and apical area expanded into a broad flat flap; basal mesal lobe divided at base into 2 long caudally projecting arms, dorsomesal arm flattened, moderately broad, apex with 5 moderately long flattened setae and a small mesal lobe, a few short spicules at base of arm, outer area of arm connected by a delicate membrane to mesal surface of gonocoxite, ventral arm long, narrow, basal portion curved ventrad and apical portion curved dorsad and mesad of outer arm, basal portion of arm covered with short spicules, apex with 3 long setae; phallosome with aedeagus divided into 2 heavily pigmented lateral plates which are connected basally, each plate curved tergomesad and with 2, 3 long basomesal teeth, paramere approximately 0.8 length of aedeagus, parameral apodeme narrow, approximately 1.76 length of paramere; sternum IX heavily pigmented, apical margin rounded and extended far cephalad, 2-4 long stout setae on caudomesal area.

**FEMALE.** Essentially as in male but with the following differences. *Head.* Antenna 1.14-1.20 length of proboscis, flagellomere 1 with basal 0.75 golden and with several small brown scales, pedicel golden-brown; maxillary palpus 0.16-0.19 length of proboscis; proboscis 1.05-1.14 length of femur I. *Thorax* (Fig. 2). Setal differences are as follows: 4-6 anterior promontory, scutal fossal (4-6 anterior and 3-5 lateral), 2-4 anterior acrostichal, scutellar (5, 6 long and 5-7 short ones on median lobe and 4-6 long and 4, 5 short setae on lateral lobe), 10-15 antepronotal, 12-16 propleural, 5-7 postspiracular, 3, 4 upper and 13-16 posterior mesepisternal, 9-13 on prealar knob, and 10-16 upper mesepimeral. *Legs.* White scaled stripes on posterior surfaces of femora larger, white stripe on femur II covering most of posterior surface; tarsomeres I-III (Fig. 28) with 2 unguis, I and II with unguis equal in size and with a tooth, III with unguis equal in size, both simple. *Wing.* Remigium with 1, 2 setae. *Genitalia* (Fig. 16). Tergum VIII with scales absent, basal 0.9-1.0 retracted into segment VII, base concave mesally, apex straight or slightly convex, numerous short setae scattered over apical 0.89-0.93, setae along apex short and thin, basolateral seta absent, VIII-Te index 0.92-0.98, VIII-Te/IX-Te index 2.23-2.60, length 0.22-0.26 mm, width 0.22-0.28 mm; sternum VIII with a large lightly pigmented median area, scales absent, base slightly concave mesally, apex with a moderately deep median indentation (0.17-0.22 of length) and a medium size lobe on each side of midline, short to moderately long setae on apical 0.88-0.96, seta 2-S approximately 0.38 from 1-S, seta 3-S approximately 0.62 from 2-S, apical intersegmental fold lightly

pigmented, VIII-S index 0.86-0.96, length 0.26-0.29 mm, width 0.30-0.32 mm; tergum IX with mesal area lightly pigmented, apex with a small median indentation and with 4-7 (usually 4, 5) setae on each side of midline, 8-12 total setae, IX-Te index 0.90-0.94, length 0.09-0.10 mm, width 0.10-1.11 mm; insula with 3-5 small tuberculi; lower vaginal lip with numerous long spicules scattered over surface, lower vaginal sclerite absent; upper vaginal lip with upper vaginal sclerite moderately pigmented, medium size; postgenital lobe with apex with a small to moderately deep median indentation (0.10-0.22 of length), 4-7 setae on each side of midline, 9-14 total setae, covered with short spicules, dorsal PGL index 0.98-1.09, ventral PGL index 1.68-2.00, ventral length 0.10-0.13 mm; cercus with 2, 3 long setae at apex, covered with short spicules, dorsal surface with a number of short to moderately long setae on apical 0.81-0.85, scales absent, ventral surface with a few short setae on lateral margin, cercus index 2.85-2.97, cercus/dorsal PGL index 3.04-3.55, cercus length 0.20-0.24 mm; one large seminal capsule, base of accessory gland duct heavily pigmented.

**PUPA** (Figs. 21, 22). Chaetotaxy as figured and recorded (Table 5). *Cephalothorax*. Seta 1-CT with 3-6 branches; 6-CT short; 8-CT with 5-10 branches; 9-CT with 3-6 branches. *Respiratory trumpet*. Index 3.21-3.63, mean 3.35. *Abdomen*. Seta 1-II with 6-12 branches; 2-II inserted mesad of 3-II; 1-III with 5-9 branches; 6-III with 4-8 branches; 5-IV-VI very long, single; 1-V with 4-6 branches; 3-V with 3, 4 branches; 6-V with 5, 6 branches; 1-VI with 3-6 branches; 6-VI with 2-6 branches; 10-VI-VII very long, single; 1-VII with 2-4 branches; 6-VII with 4-7 branches; 9-VIII very long, single. *Paddle*. Broad, with minute spicules on apical 0.58-0.72 of lateral and apical 0.09-0.13 of mesal margins; index 1.01-1.19, mean 1.09.

**LARVA** (Fig. 23). Description based on 6 larval exuviae with associated adults. Abdomen of each exuvium is twisted and damaged. *Head*. Moderately pigmented; setae 0, 1, 3, 14, 18, 20-C single; 4-C with 5-7 (6) branches, inserted mesad and only slightly caudad of 5-C; 5-C with 3 branches; 6-C with 2, 3 (2) branches; 7-C with 5-9 (7) branches; 8-C single to 3 (2) branched; 9-C with 2-4 (3) branches; 10-C with 2-5 (3) branches; 11-C with 4-8 (6) branches; 12-C with 7, 8 (8) branches; 13-C with 5-7 (6) branches; 15-C with 2, 3 (3) branches; dorsomentum with 26-28 (usually 28) teeth, heavily pigmented. *Antenna*. Scape long, index 15.31-16.90, mean 15.98; seta 1-A with 3, 4 (3) branches, inserted 0.45-0.50 from base. *Thorax*. Seta 0-P with 7-12 (9) branches; 1, 5, 6, 8, 10, 12-P single; 2, 14-P with 2 branches; 3-P with 2-4 (2) branches; 4-P single or 2 (1) branched; 7-P with 2, 3 (2) branches; 9-P single or 2 (2) branched; 11-P with 2-4 (3) branches; 1-M with 2, 3 (2) branches; 2, 5, 7, 10-12-M single; 3-M with 3, 4 (3) branches; 4-M with 4-7 (4) branches; 6-M with 3, 4 (4) branches; 8-M with 4, 5 (4) branches; 9-M with 4, 5 (5) branches; 13-M with 10-16 (10) branches; 14-M with 5-8 (8) branches; 1-T with 2, 3 (3) branches; 2-T single to 3 (2) branched; 3-T with 5-9 (9) branches; 4, 6-T with 2, 3 (2) branches; 5, 10, 12-T single; 7-T with 4-6 (4) branches; 8-T with 8-13 (9) branches; 9-T with 3 branches; 11-T single to 3 (1) branched; 13-T with 7, 8 (7) branches. *Abdomen*. Setae 0, 4, 14-VIII single; 1-VIII with 4-7 (4) branches; 2-VIII with 2, 3 (2) branches; 3-VIII with 8-13 (10) branches; 5-VIII with 3-5 (4) branches; comb on VIII with 12-18 (usually 15-17) scales; 1-X single or 2 (2) branched; 2-X with 4, 5 (5) branches; 3-X single; ventral brush with 9, 10 setae on grid, each with 3-9 branches, some setae always with 8 branches. *Siphon*. Moderately pigmented throughout length; index 1.77-1.91, mean 1.87; pecten on basal 0.59-0.66, with 18-24 (usually 21, 22) teeth, each tooth with one large and 1, 2 small ventral denticles near base, apex flattened or

with several long denticles, distal 1, 2 teeth spine-like, without denticles and wider spaced than remainder; 1-S with 4-6 (4) branches, inserted on basal 0.63-0.67 of siphon and even with or slightly distad of last pecten tooth; 2-S single, short; 6, 7, 9-S single; 8-S with 2-4 (3) branches.

**TYPE-DATA.** The holotype with its associated pupal exuvium is deposited in the USNM and possesses the following information on the adult labels and collection data sheet: THAILAND, *Prachin Buri*, Ban Bu Phram, 28 July 1971, 06045-102 [collection number], Kol Mongkolpanya and team [collectors], T75.18 [genitalia preparation number], collected as a pupa from clear, fresh, temporary water in a small crab hole, in a heavily shaded area of secondary scrub, in a valley, and at an elevation of 150 m. The holotype (USNM No. 76351) is in excellent condition. The genitalia are mounted in Canada balsam on a microscope slide and are in excellent condition. The allotype with its associated pupal exuvium possesses the following collection information: THAILAND, *Prachin Buri*, Ban Tub Lan, 11 August 1971, 06061-101, Kol Mongkolpanya and team, immature collection data as for holotype except for elevation which is 80 m. Paratypes are as follows: 06038-1 (♀ pl), -2 (♀ pl), -100 (♀ pl), collection data as for allotype except date which is 27 July 1971; 06045-7 (♀ pl), -9 (♀ pl), -11 (♀ pl), -100 (♂), -101 (♂ p), -104 (♀ p), 06045 (♀), collection data as for holotype; 06055-100 (♂ p), -101 (♂ p), collection data as for allotype except date which is 29 July 1971; 06061-1 (♀ pl), -100 (♂ p), -102 (♂ p), collection data as for allotype; and 06062 (28 ♀), collected biting man in a secondary deciduous forest with bamboo, in partial shade, in mountainous terrain and at an elevation of 500 m, on 12 August 1971, at Khao Chang Chalut, other data as for holotype. The type-specimens are deposited in the USNM except for 2 female and one male paratypes (with associated exuviae) which are deposited in the BMNH and 2 female paratypes (one with associated exuvium deposited in the Bernice P. Bishop Museum.

**DISTRIBUTION.** Eighty-four specimens examined: 7 ♂p, 1 ♂, 6 ♀pl, 3 ♀p and 45♀.

THAILAND. *Khon Kaen*, Amphoe Chum Phae, Pha Dong Larn, 25-28 Nov. 1962, T-1820, -1837, -1838, -1839, -1847, 8♀. *Nakhon Ratchasima*, Amphoe Pak Chong, Nong Sa Rai, 20 May 1963, P. Boonyakanist, T-8404, 1♀. *Nan*, Ban Sala, 6 Aug. 1966, S. Maneechai, 01364-104, 1 ♂p. *Prachin Buri*, Ban Bu Phram, 12, 28 Jul. 1971, K. Mongkolpanya and team, 06025, 06045-7, -9, -11, -100, -101, -102, -104, 1 ♂p (holotype), 1 ♂p, 1 ♂, 3 ♀pl and 1 ♀p (paratypes), and 3♀; same except Ban Tub Lan, 27, 29 Jul. 1971, 06038-1, -2, -100, 06055-100, -101, 06061-1, -100, -101, -102, 4 ♂p, 3 ♀pl, 1 ♀p (paratypes) and 1 ♀p (allotype); same except Khao Chang Chalut, 6 Jul. and 12 Aug. 1971, 06005, 06062, 28 ♀ (paratypes), and 3♀.

VIETNAM. *Khanh Hoa*, Duc My, 2 Oct. 1966, Lt. Erickson and VHL Beardsley, 1505, 2♀.

#### *Distribution from literature.*

THAILAND and VIETNAM. As reported above (Reinert 1976b: 325).

**DISCUSSION.** The adult habitus of both sexes of *thailandensis* are very similar, a condition which differs from the marked sexual dimorphism of most species of the subgenus. Adults of *thailandensis* are easily separated from the other species of *Paraedes* (*barraudi*, *bonneae*, *chrysoscuta*, *collessi*, *menoni*, *ostentatio* and *pagei*) by the combination of antepronotum with broad and a few narrow white scales, paratergite with narrow white scales, postpronotum with broad white scales, and the scale patterns of the vertex and scutum. Reinert (1976b: 320) reported the posttarsi I and II of the male as having the unguis simple; only the larger unguis are simple, the smaller ones

each have a small tooth.

The male genitalia of *thailandensis* are very distinctive (see Fig. 9), as are all species of the subgenus *Paraedes*, in the development of the gonostylus and basal mesal lobe.

Female genitalia of *thailandensis* (see Fig. 16) can be separated from the other species of the subgenus by the combination of the following features: sternum VIII shape and pale pigmented median area; tergum VIII shape and nearly covered with setae; and number of setae on tergum IX. From *menoni* it is distinguished by having only a single seminal capsule while *menoni* has 3.

Pupae of *thailandensis* are easily separated from those of the other known species by the following: paddle broad, index 1.01-1.19; 5-IV-VI length greater than 1.5 length of attached terga; 10-VI, VII very long; 4-VIII very long; and 9-VIII long, 0.60-1.18 length of paddle. Seta 2-II inserted mesad and cephalad of 3-II which is similar to *chrysoscuta* and *ostentatio*, but differs from *bonneae* and *collessi* which have 2-II inserted laterad and cephalad of 3-II.

Larvae of *thailandensis* possess a number of unique features which easily distinguish them from the other known species of the subgenus. These are: seta 5-C with 3 branches; 6-C with 2, 3 branches; 2-M single; 3-M with 3, 4 branches; 2-X with 4, 5 branches; pecten with 18-24 teeth; shape of pecten teeth (see Fig. 23); siphon moderately pigmented throughout length; siphon index 1.77-1.91; and antennal scape index 15.31-16.90.

BIONOMICS. Adults have been taken in Thailand feeding on man in heavy vegetation of a forest (1900-2000 h), a secondary deciduous forest, bamboo groves (500 m elevation), and resting in forest vegetation. In Vietnam one female was collected biting man (2000 h) near a salt marsh and an additional female was taken in a CDC light trap.

The usual immature habitat is fresh water in crab holes located at elevations of 80-150 m. Immatures in Thailand were collected from clear, temporary water in small crab holes (5 times), once from a small wheel track, located in partially and heavily shaded areas of secondary scrub and in a bamboo grove, all located in valley terrain, and at elevations from 80-300 m.

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#### LITERATURE CITED

##### ARMY MOSQUITO PROJECT.

1965. Preliminary keys to the mosquitoes of Vietnam.  
Dept. Entomol., Smithson. Inst., U. S. Nat. Mus.,  
Wash., D. C. 76 p.

##### BARRAUD, P. J.

1928. A revision of the culicine mosquitoes of India.  
Part XXIV. The Indian species of the subgenera  
*Skusea* and *Aedes*, with descriptions of eight new  
species and remarks on a new method for identifying  
the females of the subgenus *Aedes*. Indian J. Med.  
Res. 16: 357-75.
1934. The fauna of British India, including Ceylon and  
Burma. Diptera V, family Culicidae, tribes  
Megarhinini and Culicini. Taylor and Francis,  
London. 463 p., 8 pl.

##### BASIO, R. G.

1971. The mosquito fauna of the Philippines (Diptera,  
Culicidae). Natl. Mus. Philipp. Monogr. No. 4,  
198 p.

##### BASIO, R. G., D. W. WHITE and W. K. REISEN.

1970. On Philippine mosquitoes II. Observations on the  
ecology of mosquitoes of Mt. Makiling and its  
environs in Luzon. Philipp. Entomol. 1: 431-51.

##### BIERY, T. L. and R. G. BASIO.

1973. Distribution and abundance of mosquitoes on USAF  
installations in the Republic of South Vietnam during  
1970, 1971 and 1972. Headquarters, First Med. Svc.  
Wing (PACAF), 1 MSM-ENT-73-86. 21p.

##### BIERY, T. L. and J. P. BURNS.

1972. Disease vector surveillance and control study Udorn  
RTAFB, Thailand. Headquarters, First Med. Svc.  
Wing (PACAF), 1 MSW-ENT-72-51. 23 p.

1973. Distribution and abundance of mosquitoes on USAF  
installations in Thailand during 1970, 1971, and 1972.  
Headquarters, First Med. Svc. Wing (PACAF),  
1 MSW-ENT-73-85, 38 p.

##### BOHART, R. M.

1945. A synopsis of the Philippine mosquitoes. U. S. Navmed.  
Bull. 580, 88 p.

- BRUG, S. L. and J. BONNE-WEPSTER.  
1947. The geographical distribution of the mosquitoes of the Malay Archipelago. *Chron. Nat.* 103: 179-97.
- BRUG, S. L. and F. W. EDWARDS.  
1931. Fauna Sumatrensis. Culicidae (Diptera). *Tijdschr. Entomol.* 74: 251-61.
- BRUNETTI, E.  
1912. Annotated catalogue of Oriental Culicidae--Supplement. *Rec. Indian Mus. (Calcutta)* 4: 403-517.  
1920. Catalogue of Oriental and south Asiatic Nemocera. *Rec. Indian Mus. (Calcutta)* 17: 1-300.
- CARTER, H. F.  
1950. Ceylon mosquitoes: Lists of species and names of mosquitoes recorded from Ceylon. *Ceylon J. Sci. (B)* 24: 85-115.
- CHOW, C. Y., E. S. THEVASAGAYAM and K. THARUMARAJAH.  
1954. Insects of public health importance in Ceylon. *Rev. Ecuat. Entomol. Parasitol.* 2: 105-50.
- DELFINADO, M. D., G. B. VIADO and L. T. CORONEL.  
1962 (1963). A checklist of Philippine mosquitoes with a larval key to genera (Diptera, Culicidae). *Philipp. J. Sci.* 91: 433-57.
- DYAR, H. G. and R. C. SHANNON.  
1925. The types of Philippine mosquitoes described by Ludlow and other notes on the fauna (Diptera, Culicidae). *Insecutor Inscitiae Menstruus* 13: 66-89.
- EDWARDS, F. W.  
1913. New synonymy in Oriental Culicidae. *Bull. Entomol. Res.* 4: 221-42.  
1922a. A synopsis of adult Oriental culicine (including megarhinine and sabethine) mosquitoes. Part I. *Indian J. Med. Res.* 10: 249-93.  
1922b. A synopsis of adult Oriental culicine (including megarhinine and sabethine) mosquitoes. Part II. *Indian J. Med. Res.* 10: 430-75.  
1928. Diptera Nematocera from the Federated Malay States museums. *J. Fed. Malay States Mus.* 14: 1-139.  
1929. Philippine nematocerous Diptera II. Culicidae. *Not. Entomol.* 9: 1-14.

1932. Diptera, Fam. Culicidae. In P. Wytsman, General Insectorum. Desmet-Verteneuil, Brussels. Fasc. 194, 258 p., 5 pl.
- HAGA, J.  
1924. Aanteekening omtrent muskieten (II). Geneesk. Tijdschr. Ned. - Ind. 64: 815-34.
- HARBACH, R. E. and K. L. KNIGHT.  
1978a. A mosquito taxonomic glossary XIV. The larval body (except chaetotaxy). Mosq. Syst. 10: 53-105.  
1978b. A mosquito taxonomic glossary XVI. Vestiture. Mosq. Syst. 10: 540-64.
- HARRISON, B. A., J. F. REINERT, S. SIRIVANAKARN, Y-M. HUANG, E. L. PEYTON and B. de MEILLON.  
1974. Distributional and biological notes on mosquitoes from Sri Lanka (Ceylon) (Diptera: Culicidae). Mosq. Syst. 6: 142-62.
- HORSFALL, W. R.  
1955. Mosquitoes, their bionomics and relation to disease. Ronald Press Co., New York. 723 p.
- HUANG, Y-M.  
1970. A note on *Aedes aurotaenius* Edwards (Diptera: Culicidae). Proc. Entomol. Soc. Wash. 72: 281-8.
- KNIGHT, K. L.  
1970. A mosquito taxonomic glossary I. Adult head (external). Mosq. Syst. News Lett. 2: 23-33.  
1971. A mosquito taxonomic glossary VII. The pupa. Mosq. Syst. News Lett. 3: 42-65.  
1978. Supplement to a catalog of the mosquitoes of the world (Diptera: Culicidae). Thomas Say Found., Entomol. Soc. Am. Suppl. vol. VI, 107 p.
- KNIGHT, K. L. and W. B. HULL.  
1953. The *Aedes* mosquitoes of the Philippine Islands III. Subgenera *Aedimorphus*, *Banksinella*, *Aedes*, and *Cancraedes* (Diptera, Culicidae). Pac. Sci. 7: 453-81.
- KNIGHT, K. L. and J. L. LAFFOON.  
1970a. A mosquito taxonomic glossary III. Adult thorax. Mosq. Syst. News Lett. 2: 132-46.  
1970b. A mosquito taxonomic glossary IV. Adult thoracic appendages. Mosq. Syst. News Lett. 2: 165-77.  
1971a. A mosquito taxonomic glossary V. Abdomen (except female genitalia). Mosq. Syst. News Lett. 3: 8-24.

- 1971b. A mosquito taxonomic glossary VIII. The larval chaetotaxy. *Mosq. Syst. News Lett.* 3: 160-94.
- KNIGHT, K. L. and A. STONE.  
1977. A catalog of the mosquitoes of the world (Diptera: Culicidae). Thomas Say Found., Entomol. Soc. Am. vol. VI, 611 p.
- LAFFOON, J. L. and K. L. KNIGHT.  
1973. A mosquito taxonomic glossary IX. The larval cranium. *Mosq. Syst.* 5: 31-96.
- LEICESTER, G. F.  
1908. The Culicidae of Malaya. *Stud. Inst. Med. Res. Malaya* 3: 18-261.
- LUDLOW, C. S.  
1911. The Philippine mosquitoes. *Psyche* 18: 125-33.
- MACDONALD, W. W.  
1957. Malaysian parasites--XVI. An interim review of the nonanopheline mosquitoes of Malaya. *Stud. Inst. Med. Res. Malaya* 28: 1-34.
- MACDONALD, W. W., C. E. G. SMITH and H. E. WEBB.  
1965. Arbovirus infections in Sarawak: Observations on the mosquitoes. *J. Med. Entomol.* 1: 335-47.
- MATTINGLY, P. F.  
1958a. The culicine mosquitoes of the Indomalayan area. Part III. Genus *Aedes* Meigen, subgenera *Paraedes* Edwards, *Rhinoskusea* Edwards and *Cancraedes* Edwards. *Br. Mus. (Nat. Hist.)*, London, 61 p.
- 1958b. A revision of *Paraedes* Edwards and *Cancraedes* Edwards (Diptera: Culicidae). *Proc. R. Entomol. Soc. Lond. (B)* 27: 76-83.
- 1958c. Lectotypes of mosquitoes (Diptera: Culicidae) in the British Museum Part III. Genera *Sabethes*, *Udaya* and *Aedes* (subgenera *Paraedes*, *Cancraedes* and *Skusea*). *Proc. R. Entomol. Soc. Lond. (B)* 27: 105-8.
1971. Contributions to the mosquito fauna of Southeast Asia. XII. Illustrated keys to the genera of mosquitoes (Diptera, Culicidae). *Contrib. Am. Entomol. Inst. (Ann Arbor)* 7(4): 1-84.
- MOULTON, J. C.  
1914. The mosquitoes of Borneo. *Rep. Sarawak Mus.* 13: 46-8.

- PARRISH, D. W.
- 1968a. The occurrence and known human-disease relationships of mosquitoes on USAF installations in the Republic of Vietnam. U. S. Air Force 5th Epidemiol. Flight, 5EF-TR-68-1. 23 p.
- 1968b. The occurrence and known human disease relationships of mosquitoes of USAF installations in Thailand. U. S. Air Force 5th Epidemiol. Flight, 5EF-TR-68-1. 18 p.
1969. Species composition and human disease relationships of mosquitoes on U. S. Air Force bases in the Republic of Vietnam. Mosq. News 29: 552-6.
- QUTUBUDDIN, M.
1960. Mosquito studies in the Indian subregion Part I. Taxonomy--a brief review. Pac. Insects 2: 133-47.
- RAMACHANDRAN, C. P., W. H. CHEONG, S. SIVANANDAM, A. H. B. OMAR and S. MAHADEVAN.
1970. Filariasis in Ulu Trengganu, West Malaysia: parasitological and entomological observations. Southeast Asia J. Trop. Med. Public Health 1: 505-15.
- REISEN, W. K., J. P. BURNS and R. G. BASIO.
1971. The distribution and abundance of mosquitoes on USAF installations in Asia for 1970. 1st Med. Serv. Wing (PACAF). 40 p.
- REINERT, J. F.
1974. Terminology and preparation techniques of the female genitalia of aedine mosquitoes (Diptera: Culicidae). Mosq. Syst. 6: 46-56.
- 1976a. Medical entomology studies-IV. The subgenera *Indusius* and *Edwardsaedes* of the genus *Aedes* (Diptera: Culicidae). Contrib. Am. Entomol. Inst. (Ann Arbor) 13(1): 1-45.
- 1976b. A new man-biting species of *Aedes* (*Paraedes*) from Southeast Asia (Diptera: Culicidae). Mosq. Syst. 8: 319-31.
1979. A description of *Isoaedes*, a new subgenus of *Aedes* Meigen, and its type-species, *Ae. (Isa.) cavaticus* new species (Diptera: Culicidae). Mosq. Syst. 11: 144-62.
- ROZEBOOM, L. E. and B. D. CABRERA.
1965. Filariasis caused by *Brugia malayi* in the Republic of the Philippines. Am. J. Epidemiol. 81: 200-15.

- SENIOR-WHITE, R.
1923. Catalogue of Indian insects. Part 2 -- Culicidae. Superintendent Gov. Print. India, Calcutta. 124 p.
1927. Notes on Ceylon mosquitoes, -- II. The larvae of the commoner non-anopheline mosquitoes. Spolia Zeylan. Bull. Natl. Mus. Ceylon 14: 61-76.
- STOJANOVICH, C. J. and J. G. SCOTT.
1965. Illustrated key to *Aedes* mosquitoes of Vietnam. U. S. Dep. Health Educ. Welfare, Public Health Serv. 34 p.
1966. Illustrated key to mosquitoes of Vietnam. U. S. Dep. Health Educ. Welfare, Public Health Serv. 158 p.
- STONE, A. and M. D. DELFINADO.
1973. Family Culicidae. p. 266-343. In M. D. Delfinado and D. E. Hardy, Ed. A catalog of the Diptera of the Oriental region. Volume I. Suborder Nematocera. Univ. Press Hawaii, Honolulu. 618 p.
- STONE, A. and K. L. KNIGHT.
1956. Type specimens of mosquitoes in the United States National Museum: II, the genus *Aedes* (Diptera, Culicidae). J. Wash. Acad. Sci. 46: 213-28.
- STONE, A., K. L. KNIGHT and H. STARCKE.
1959. A synoptic catalog of the mosquitoes of the world (Diptera, Culicidae). Thomas Say Found., Entomol. Soc. Am. vol. VI, 358 p.
- STONE, A., J. E. SCANLON, D. L. BAILEY, M. D. DELFINADO and R. A. BRAM.
1966. Preliminary keys to mosquitoes of Vietnam. Army Mosq. Project, Smithson. Inst. 92 p.
- THEOBALD, F. V.
1910. A monograph of the Culicidae or mosquitoes. Mainly compiled from collections received at the British Museum. Br. Mus. (Nat. Hist.), London, vol. V. 646 p., 6 pl.
- THURMAN, D. C., JR.
1954. The discovery of *Paraedes (Udaya) argyrurus* Edwards, 1934, in Thailand (Diptera: Culicidae). Mosq. News 14: 83-6.
- WHARTON, R. H., D. E. EYLES, M. WARREN and W. H. CHEONG.
1964. Studies to determine the vectors of monkey malaria in Malaya. Ann. Trop. Med. Parasitol. 58: 56-77.

WILKINSON, R. N., D. J. GOULD, P. BOONYAKANIST and H. E. SEGAL.  
1978. Observations on *Anopheles balabacensis* (Diptera:  
Culicidae) in Thailand. J. Med. Entomol. 14: 666-71.

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## FIGURE ABBREVIATIONS

## Male Genitalia

Ae	= Aedeagus	PaA	= Parameral apodeme
BML	= Basal mesal lobe	Par	= Paramere
Gc	= Gonocoxite	Pha	= Phallosome
Gs	= Gonostylus	Ppr	= Paraproct
IX-S	= Sternum 9	Pr	= Proctiger
IX-Te	= Tergum 9	X-Te	= Tergum 10

## Female Genitalia

AGDuB	= Accessory gland duct base	SCa	= Seminal capsule
Ce	= Cercus	SCaP	= Seminal capsule pore
DPGL	= Line of attachment of perianal membrane to dorsal surface of PGL	Tu	= Tuberculus
H	= Hinge	UVL	= Upper vaginal lip
I	= Insula	UVS	= Upper vaginal sclerite
IX-Te	= Tergum 9	VIII-S	= Sternum 8
LVL	= Lower vaginal lip	VIII-Te	= Tergum 8
PGL	= Postgenital lobe	1-3-S	= Setae 1, 2, 3-S of VIII-S

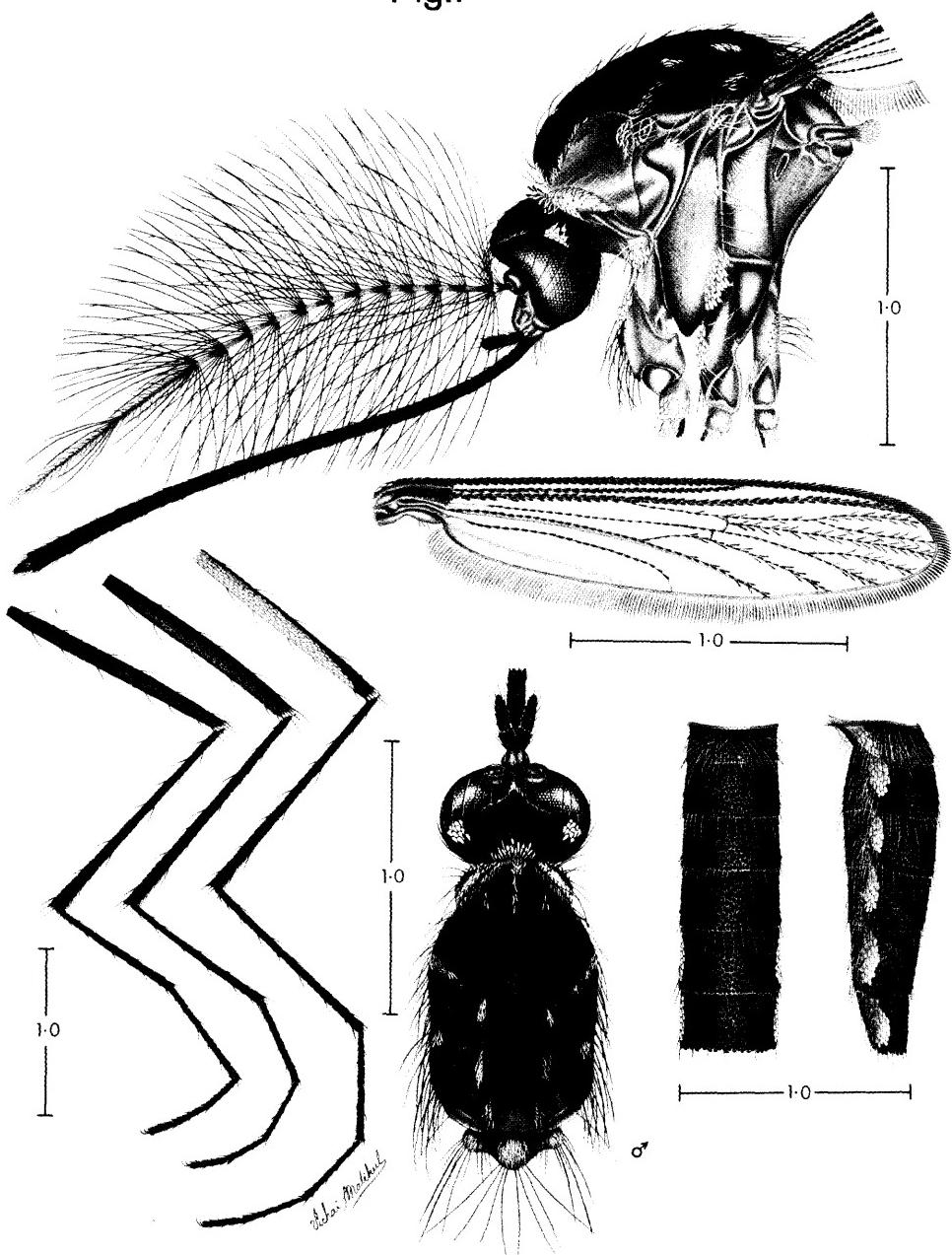
## Pupa

CT	= Cephalothorax	MP	= Metanotal plate
I-IX	= Abdominal segments 1-9	P	= Paddle

## Larva

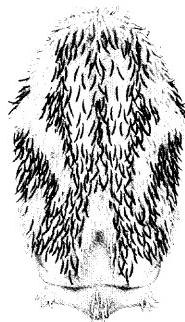
A	= Antenna	P	= Prothorax
C	= Head	PT	= Pecten tooth
CS	= Comb scale	S	= Siphon
Dm	= Dorsomentum	Sca	= Scape
I-VIII, X	= Abdominal segments 1-8, 10	T	= Metathorax
M	= Mesothorax	VmCS	= Ventromedian cervical sclerite

Fig.1



*Aedes (Paraedes) barraudi*

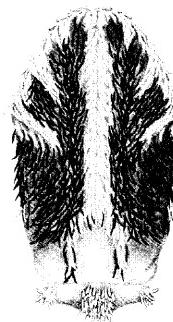
Fig. 2



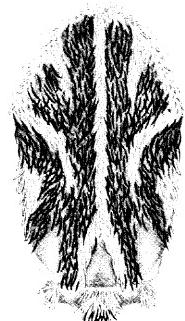
*menoni* ♀



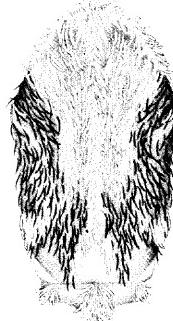
antepronotum



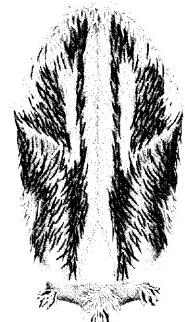
*thailandensis* ♀



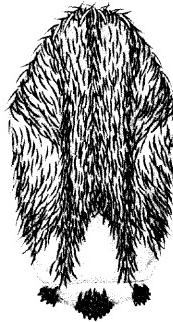
*pagei* ♀



*collessi* ♀



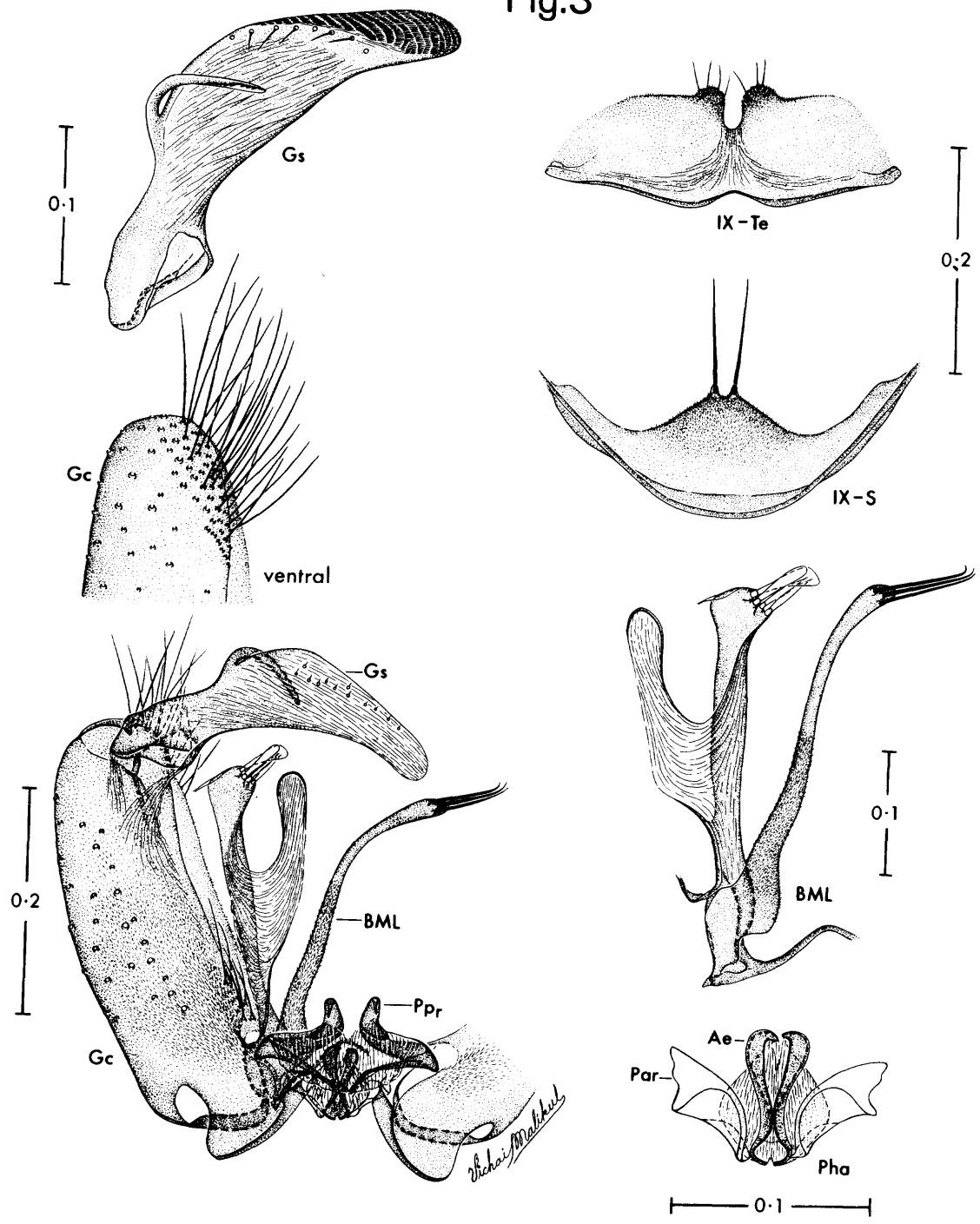
*ostentatio* ♀



*bonneae* ♀

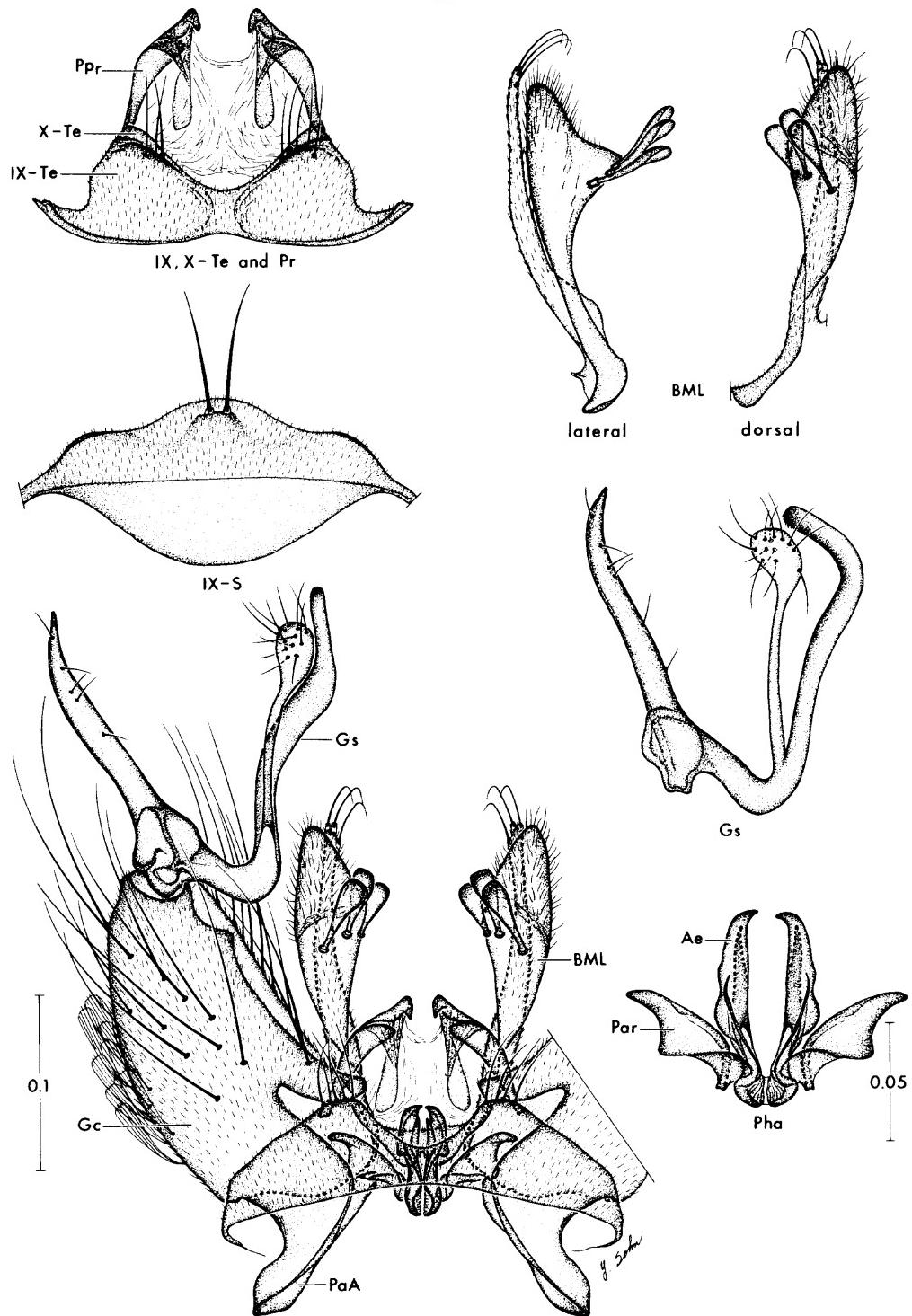


Fig.3



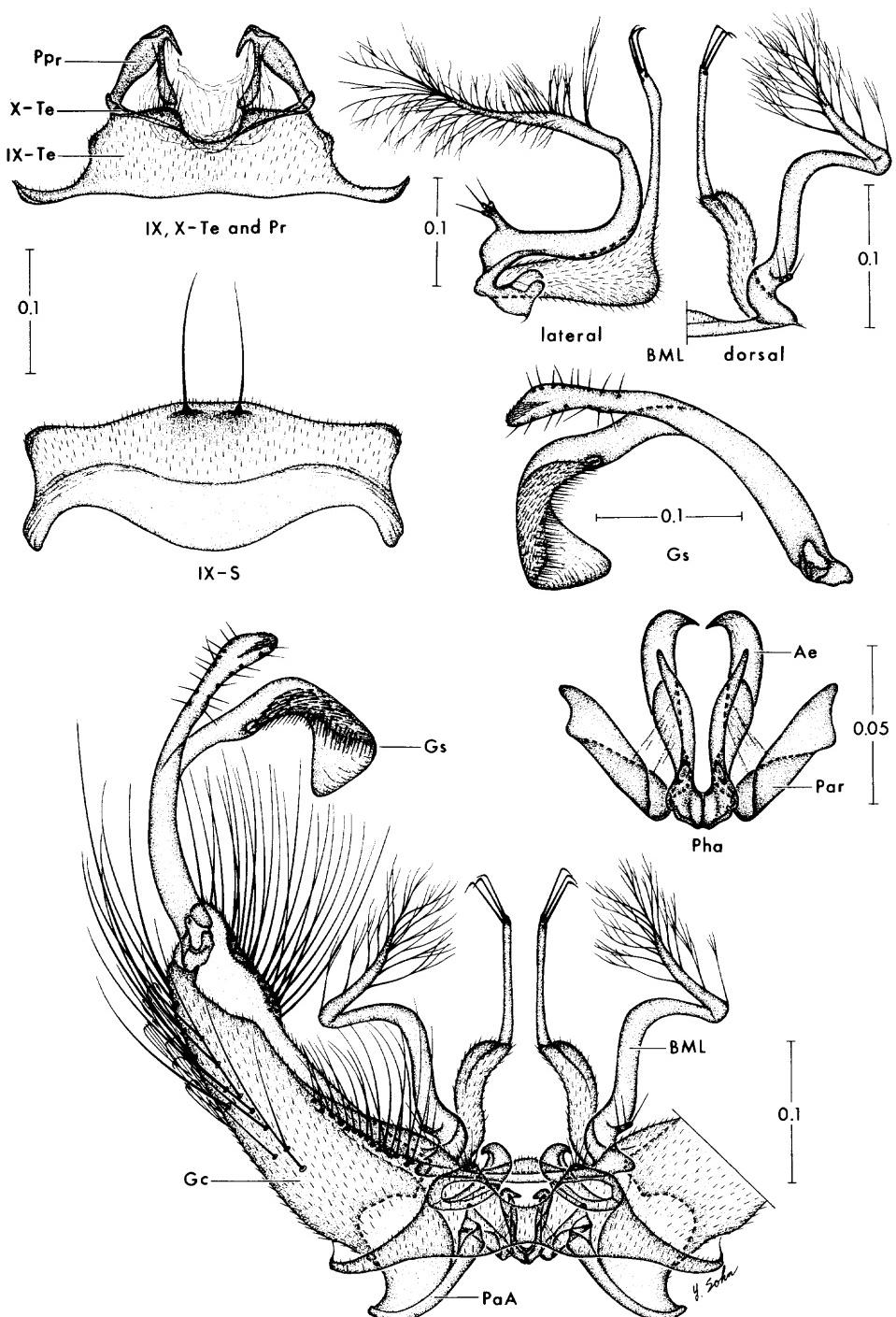
*Aedes (Paraedes) barraudi*

Fig. 4



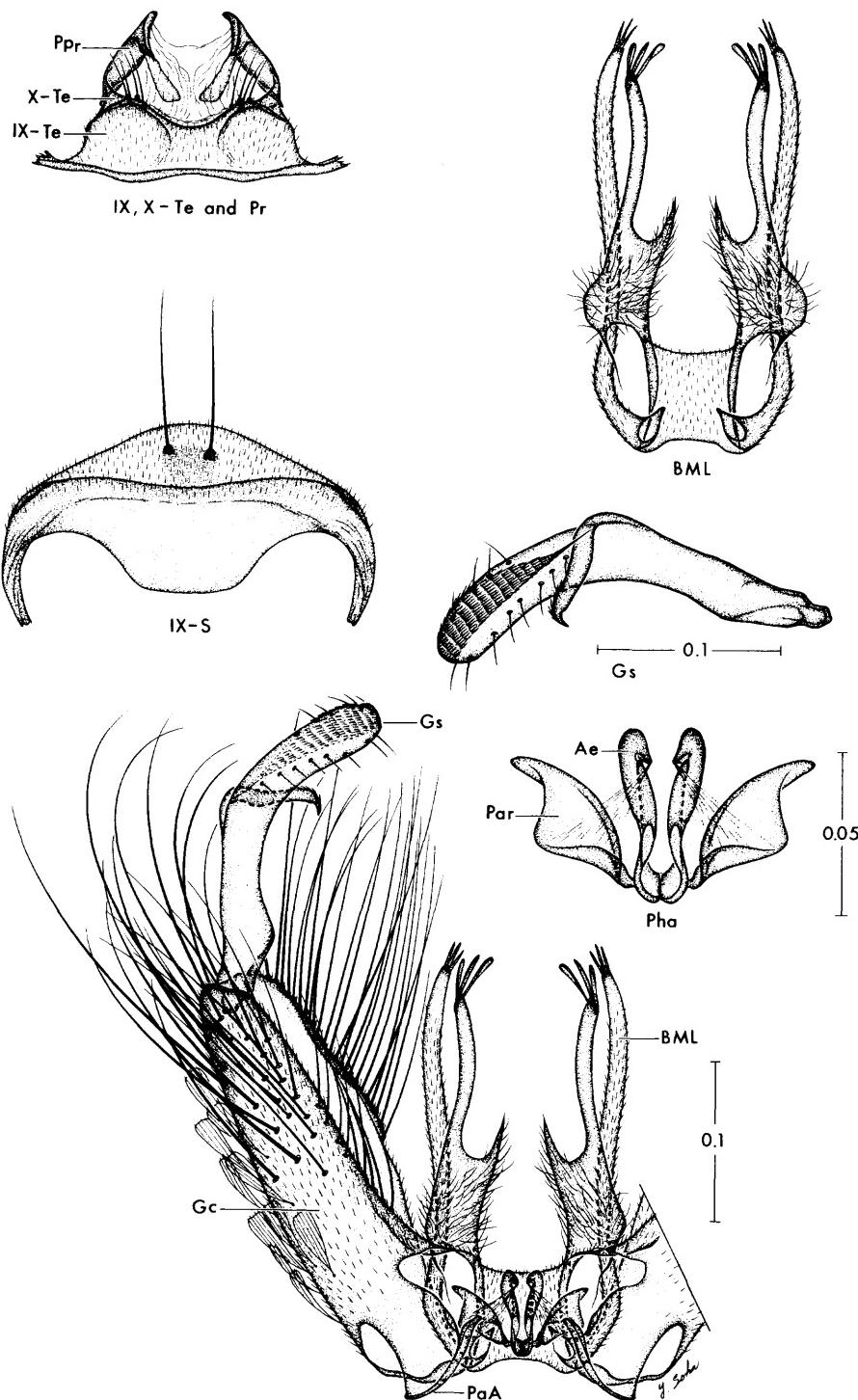
*Aedes (Paraedes) bonneae*

Fig. 5



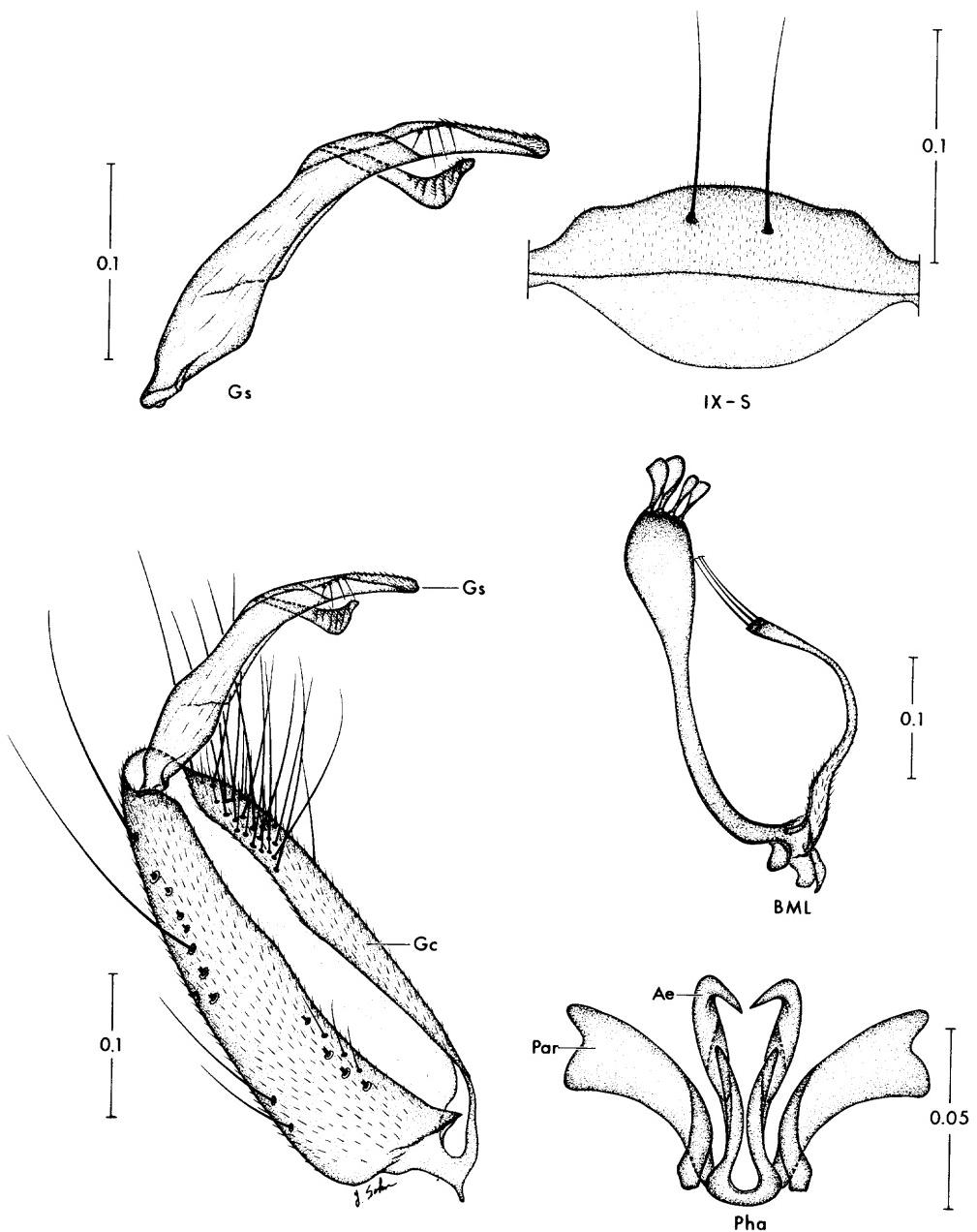
*Aedes (Paraedes) chrysoscuta*  
SRI LANKA

Fig.6



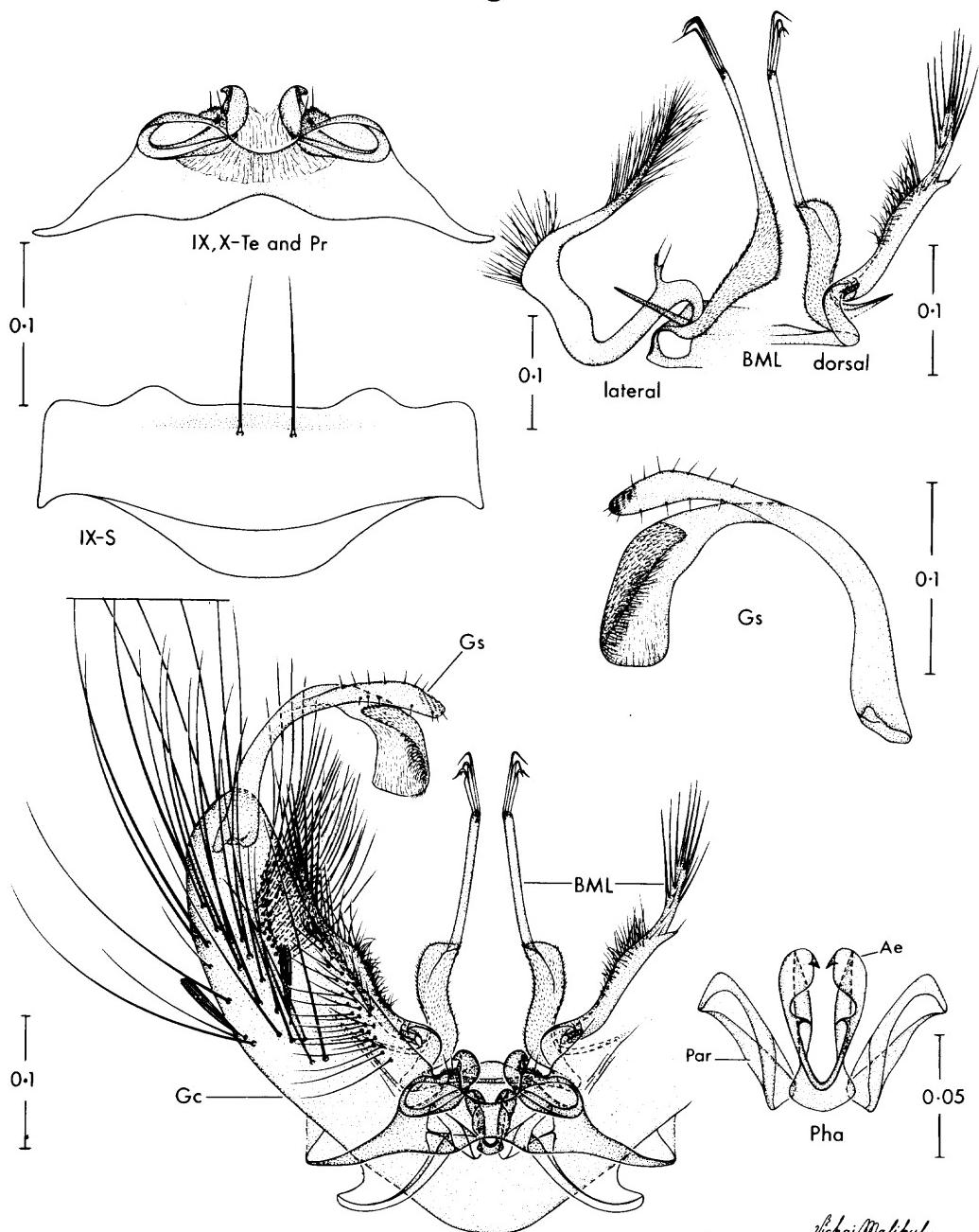
*Aedes (Paraedes) collessi*

Fig. 7



*Aedes (Paraedes) menoni*

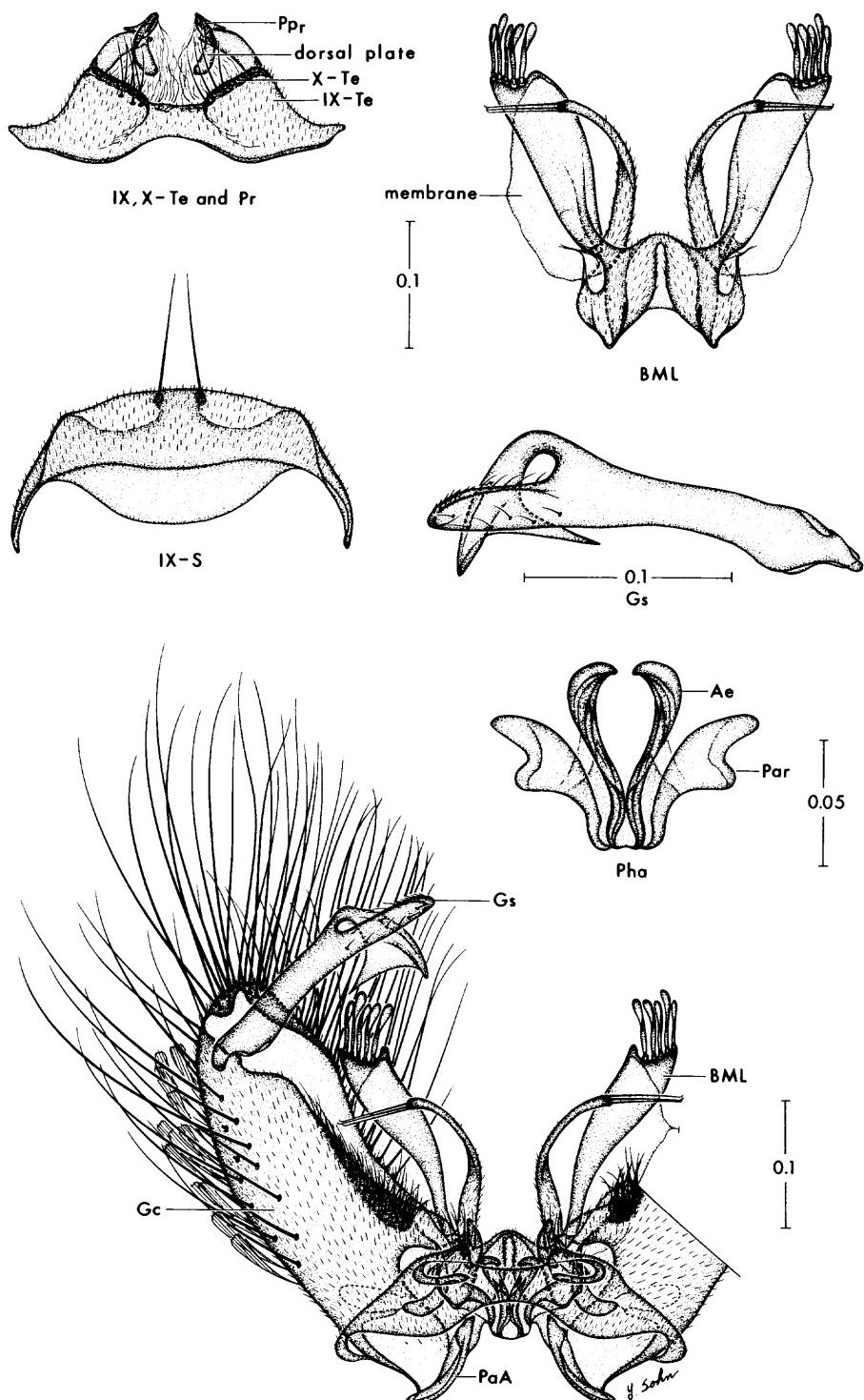
Fig. 8



*Aedes (Paraedes) ostentatio*  
THAILAND

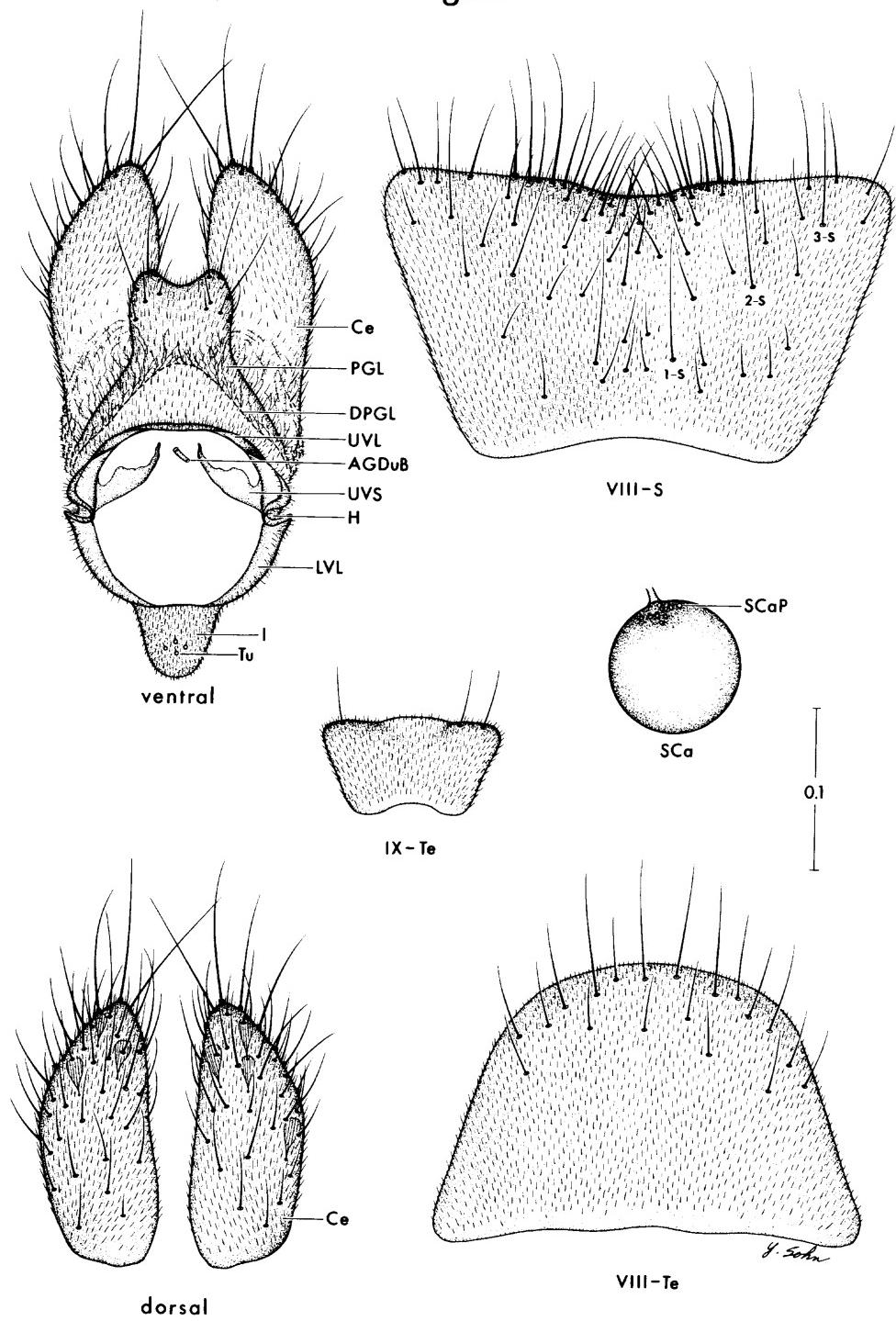
*Rachai Malikul*

Fig. 9



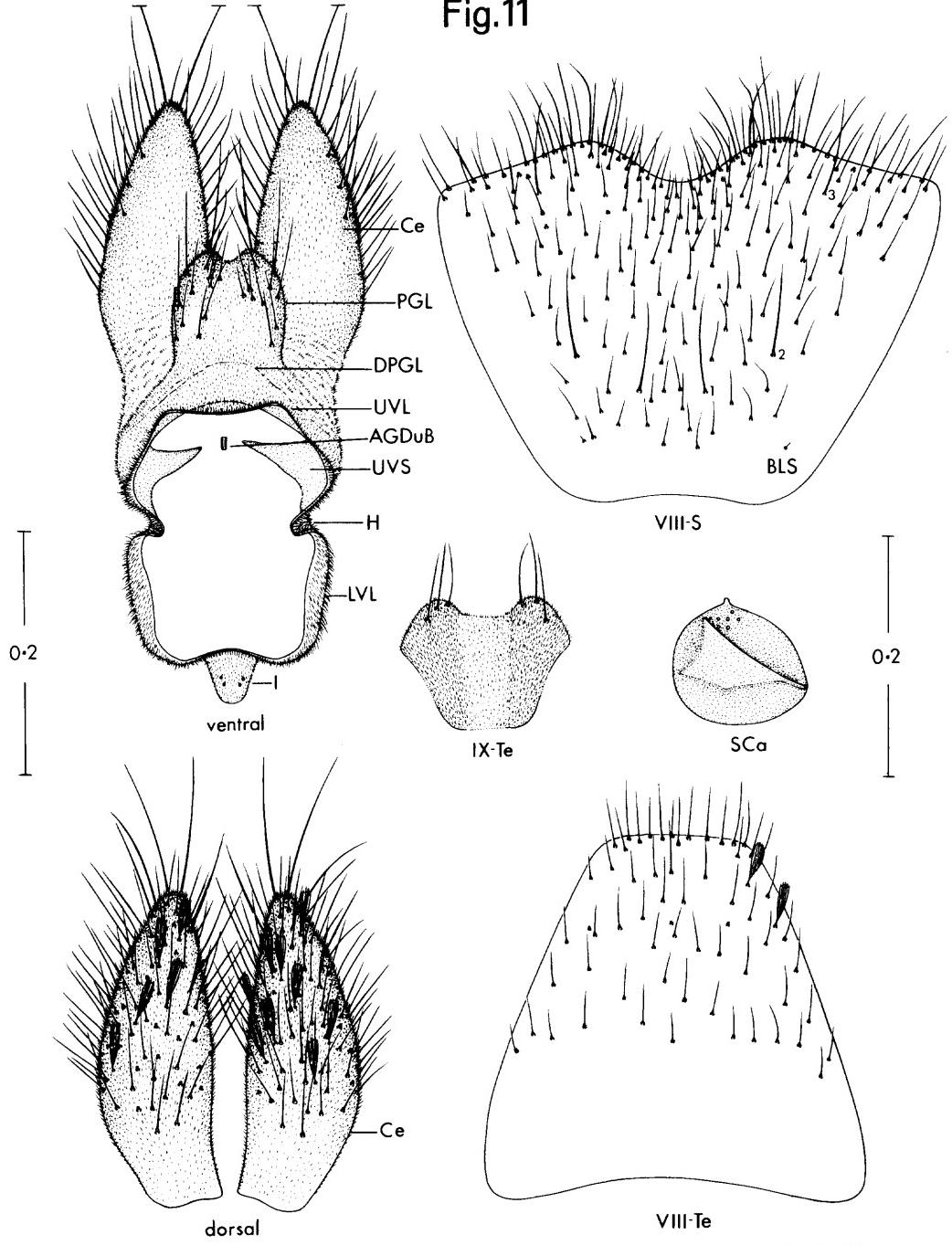
*Aedes (Paraedes) thailandensis*

Fig.10



*Aedes (Paraedes) bonneae*

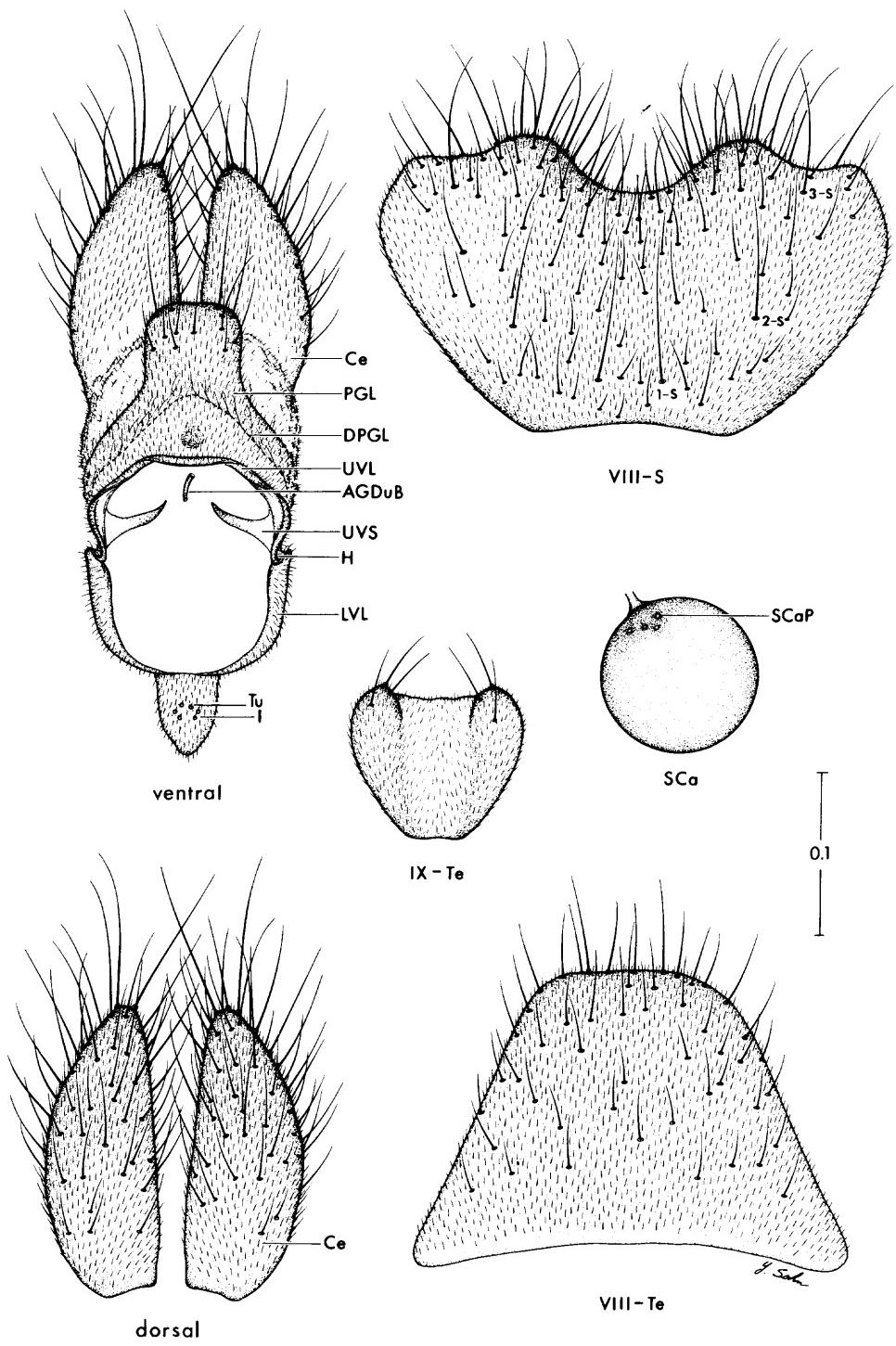
Fig.11



*Aedes (Paraedes) chrysoscuta*

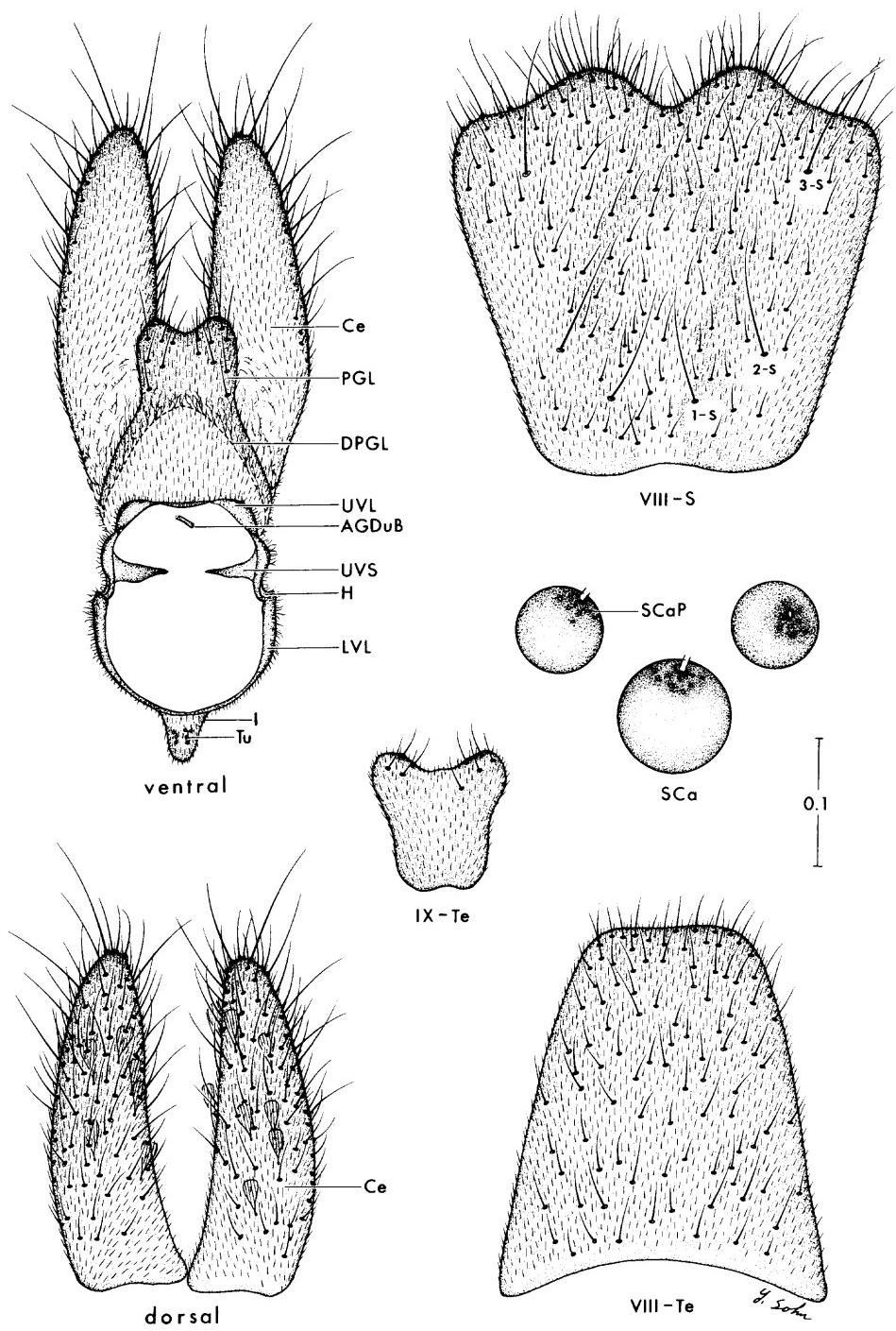
Vishai Malikhul

Fig.12



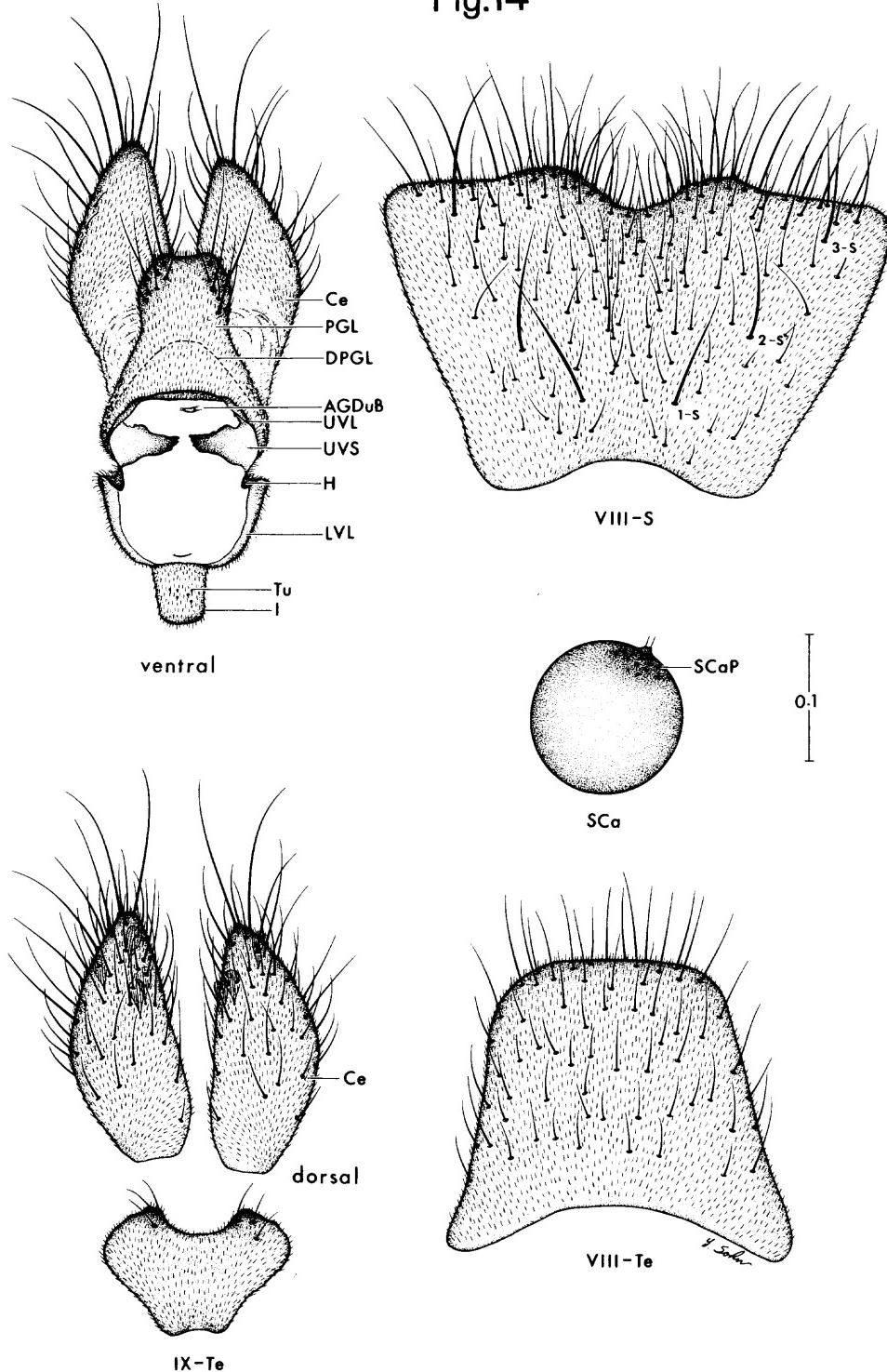
*Aedes (Paraedes) collessi*

Fig.13



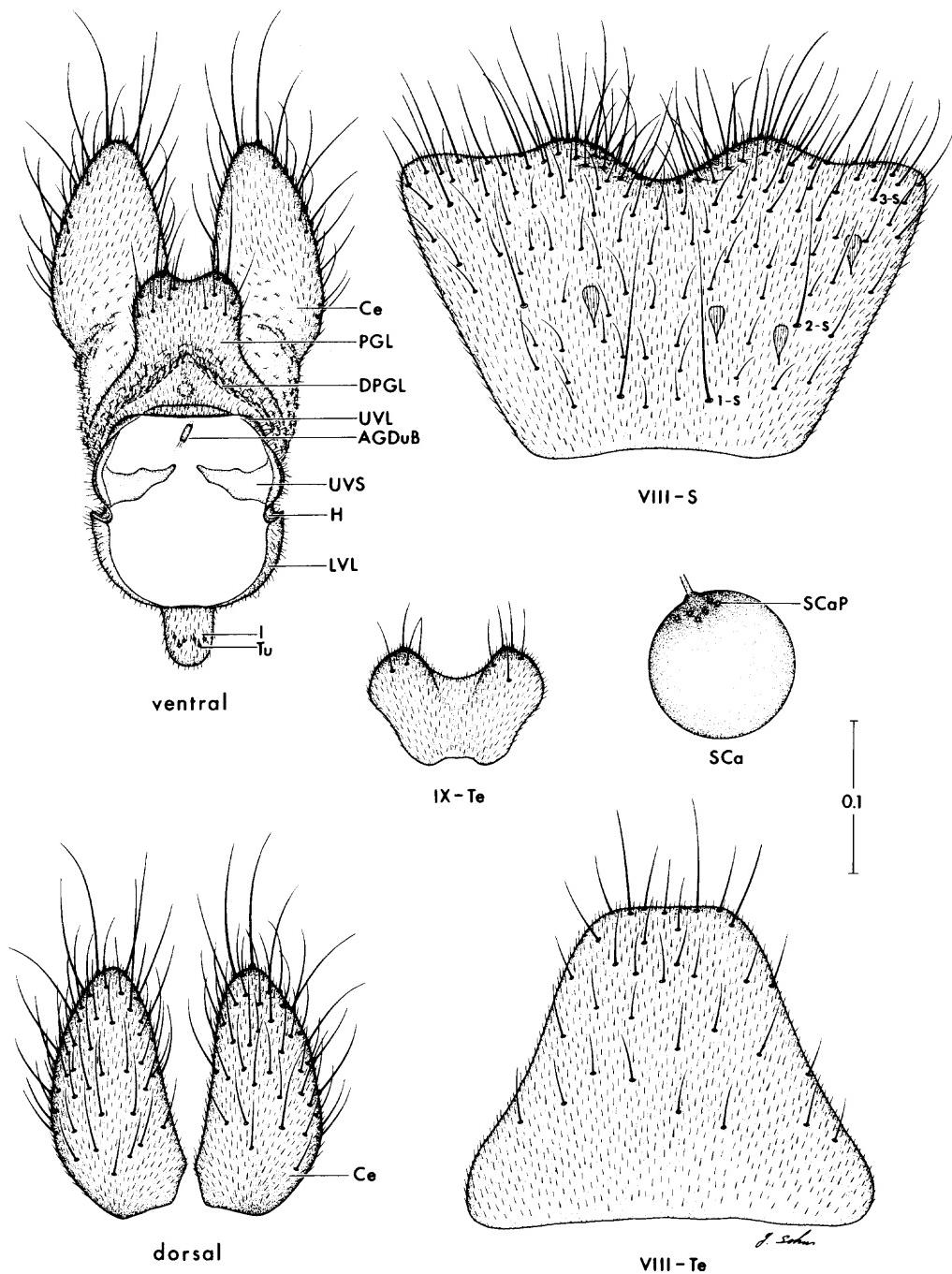
*Aedes (Paraedes) menoni*

Fig.14



*Aedes (Paraedes) ostentatio*  
THAILAND

Fig.15



*Aedes (Paraedes) pagei*

Fig.16

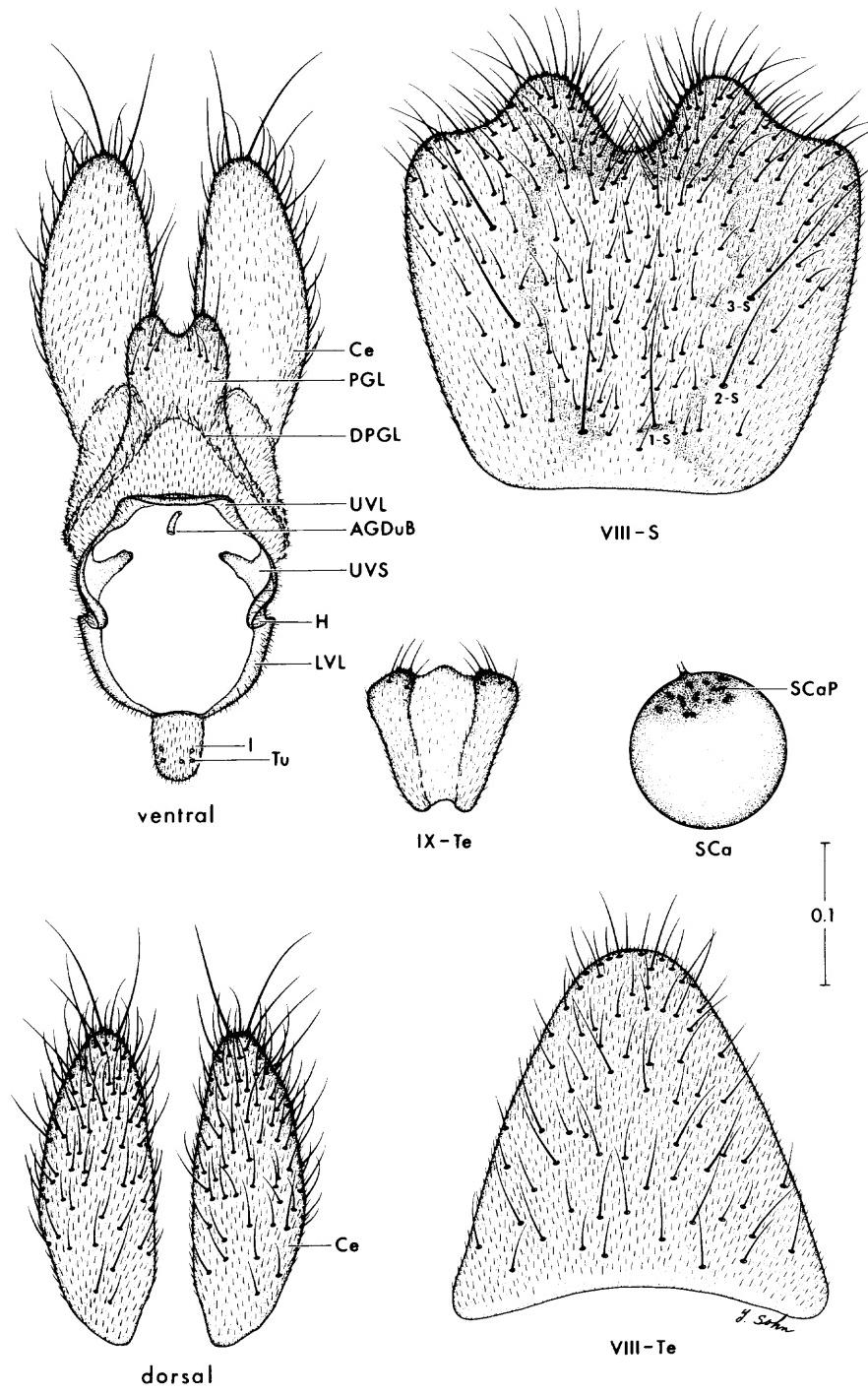
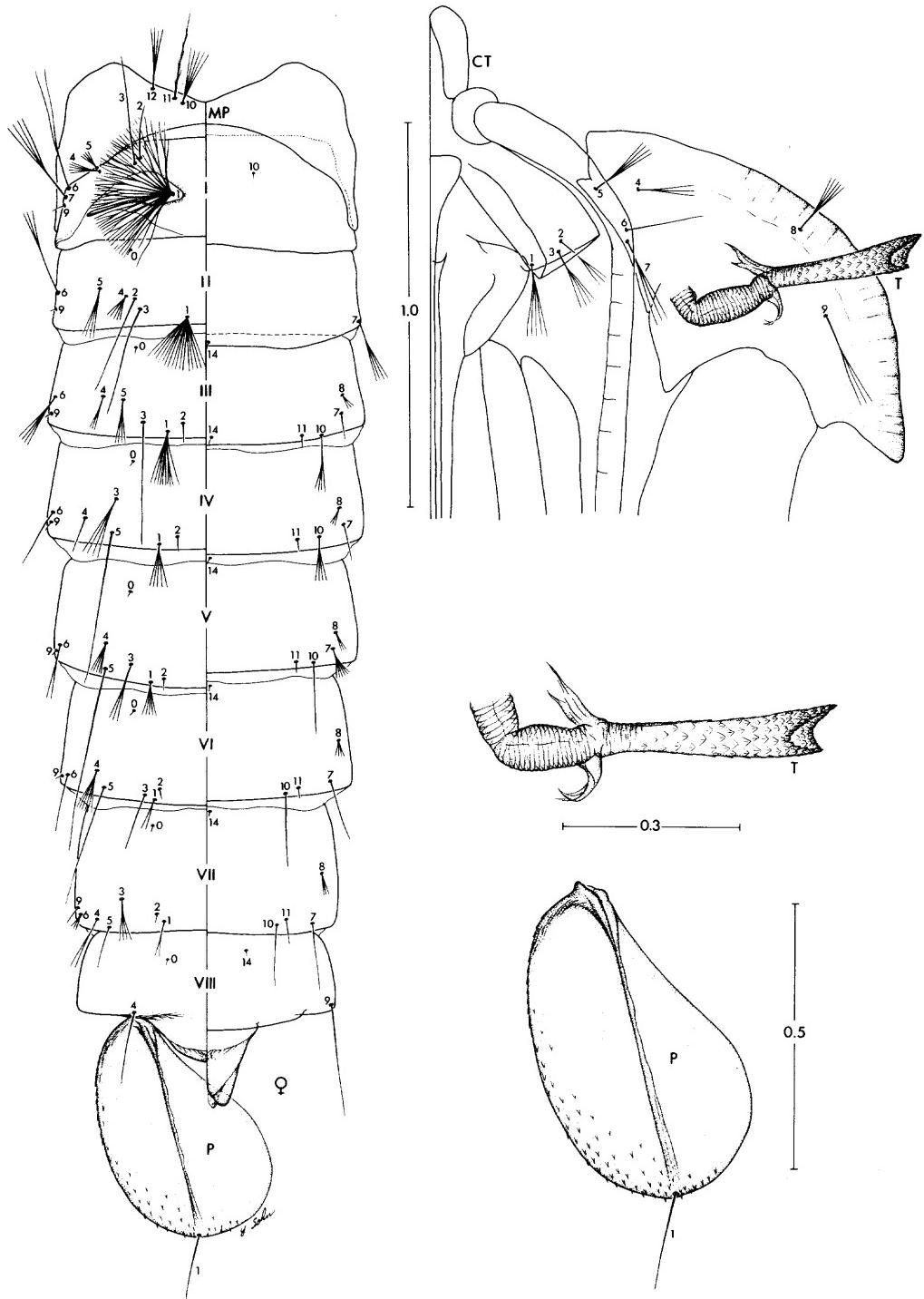
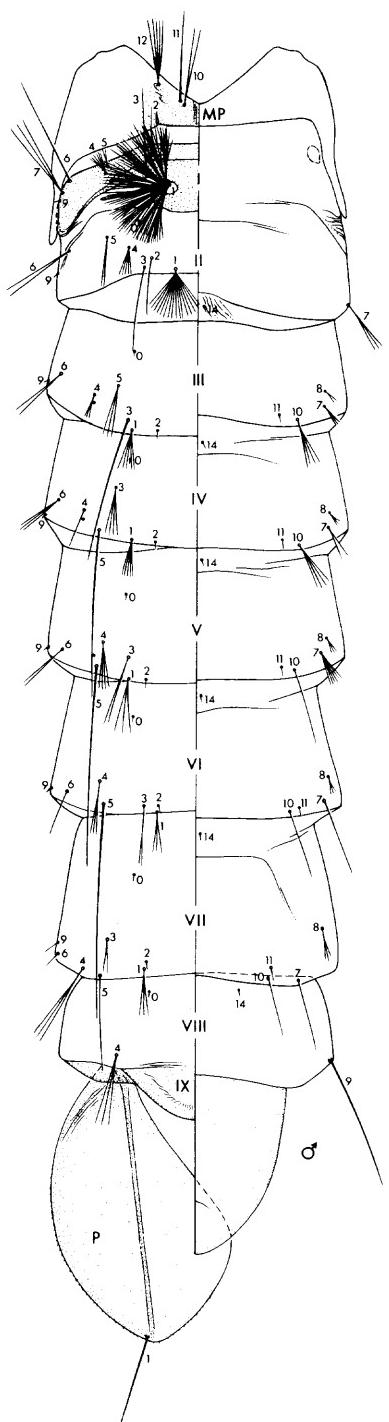


Fig.17

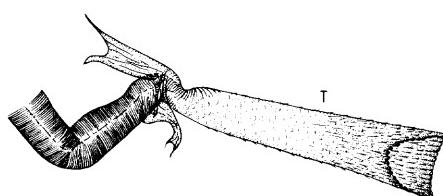
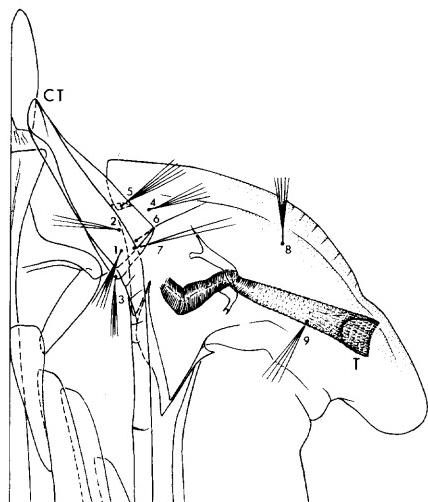


*Aedes (Paraedes) bonneae*

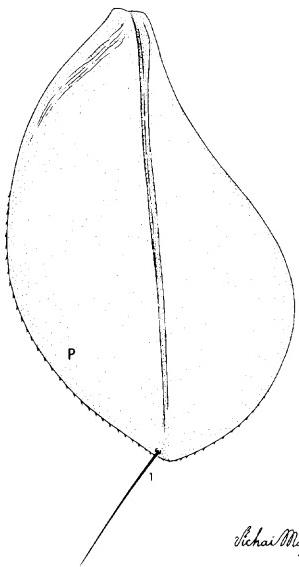
Fig.18



1-0



0.5

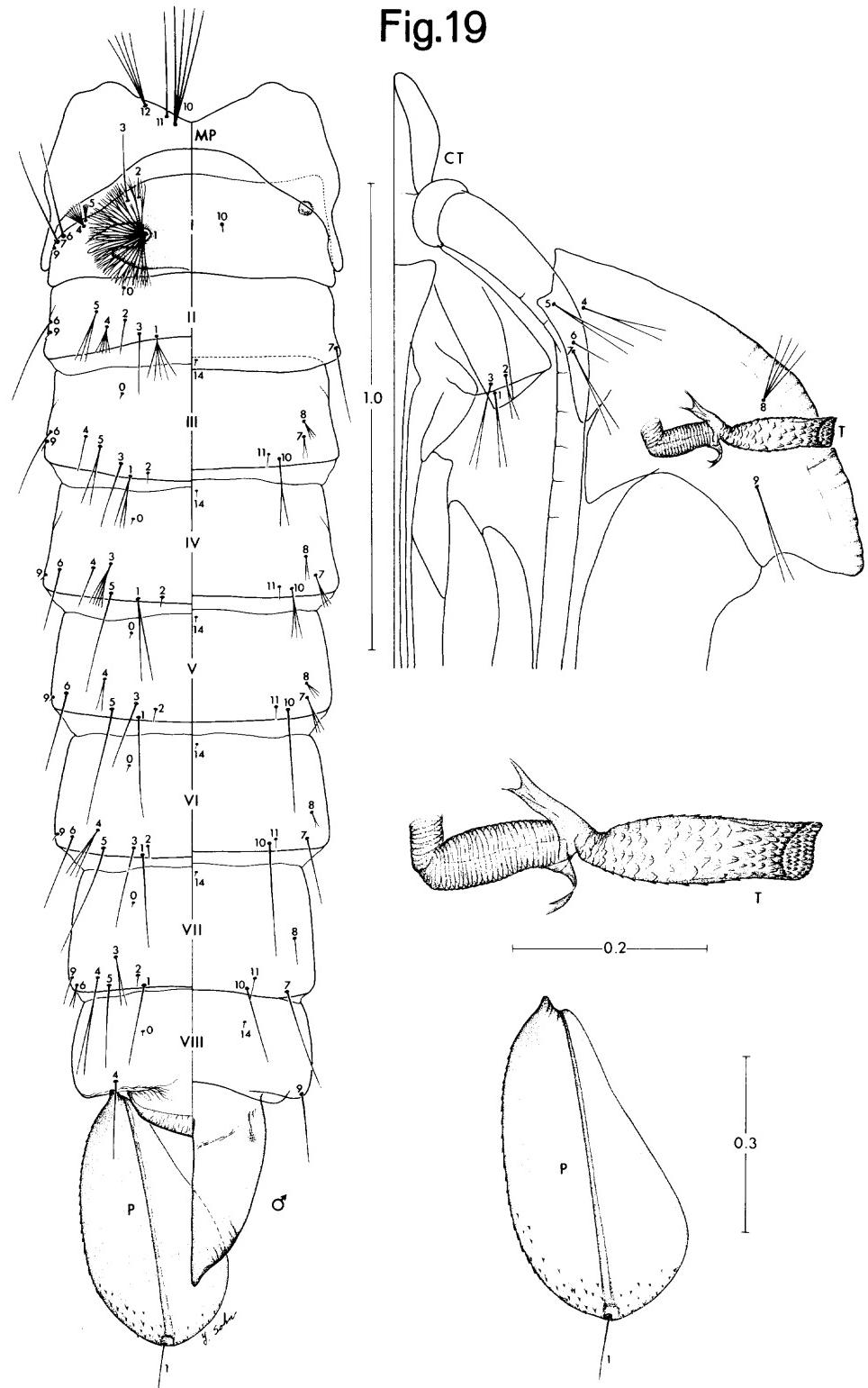


0.5

Sohail Malikul

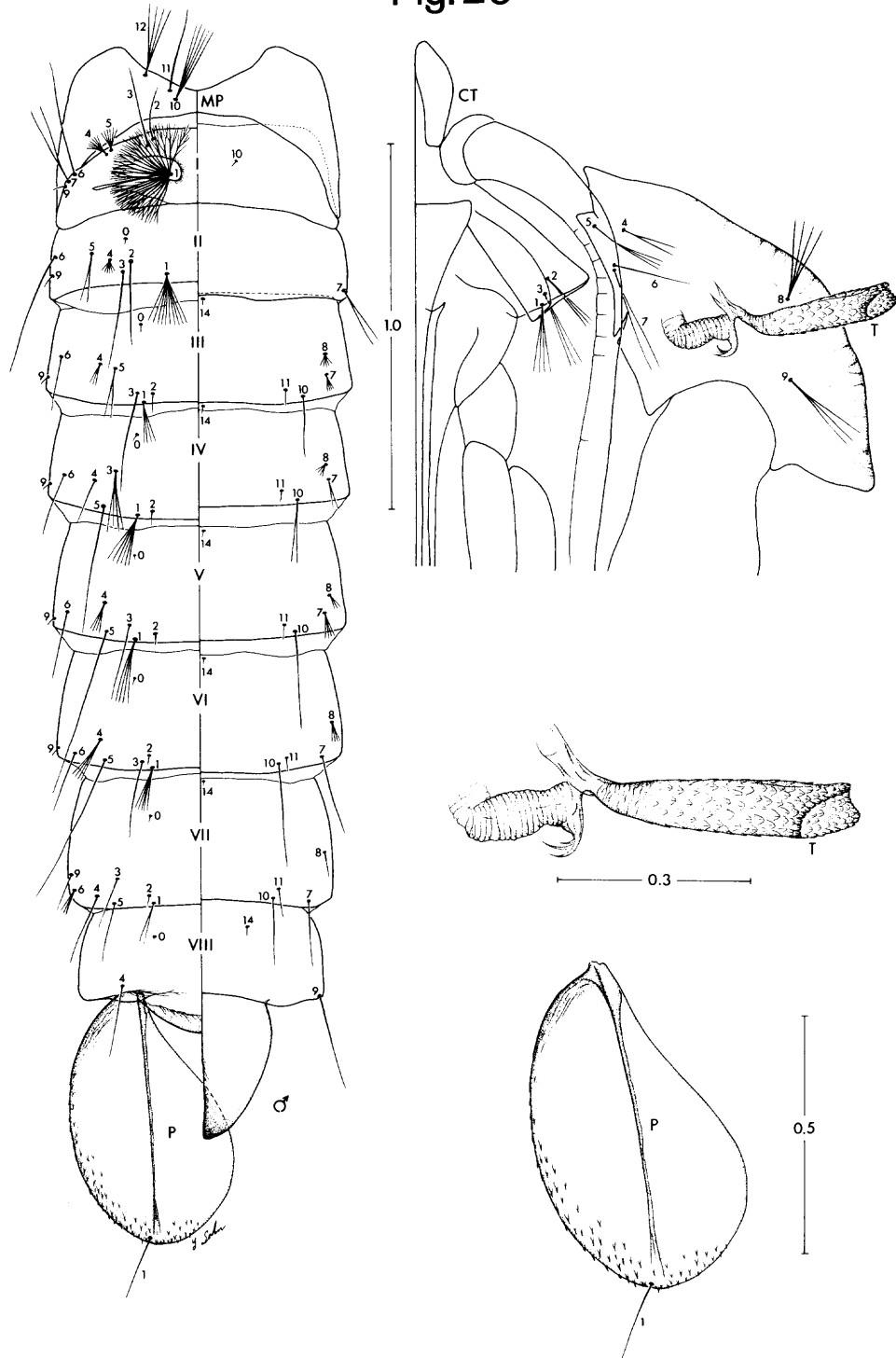
*Aedes (Paraedes) chrysoscuta*  
SRI LANKA

Fig.19



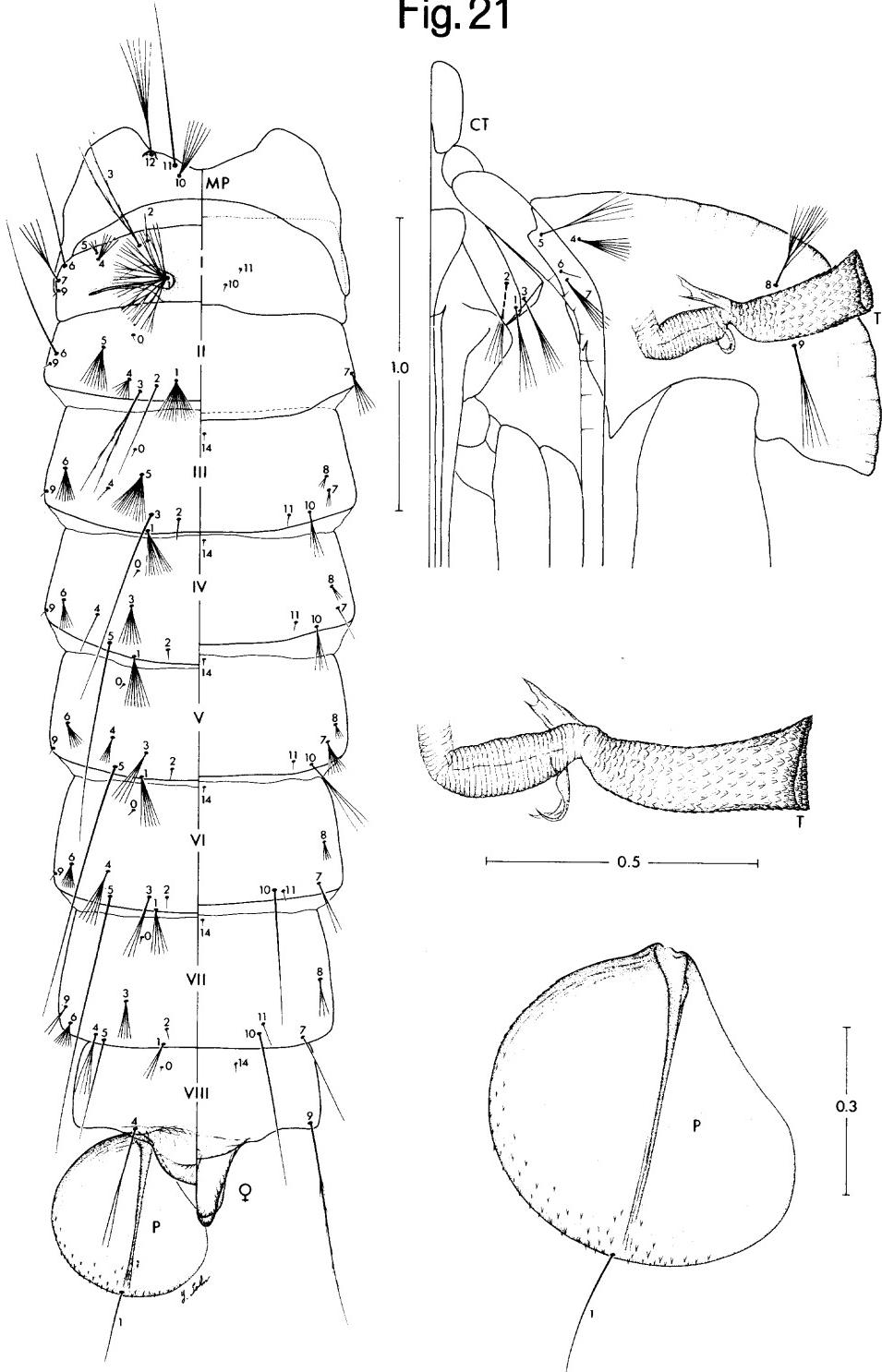
*Aedes (Paraedes) collessi*

Fig. 20



*Aedes (Paraedes) ostentatio*  
MALAYSIA

Fig. 21



*Aedes (Paraedes) thailandensis*

Fig. 22

Male Genital Lobes of *Paraedes* Pupae

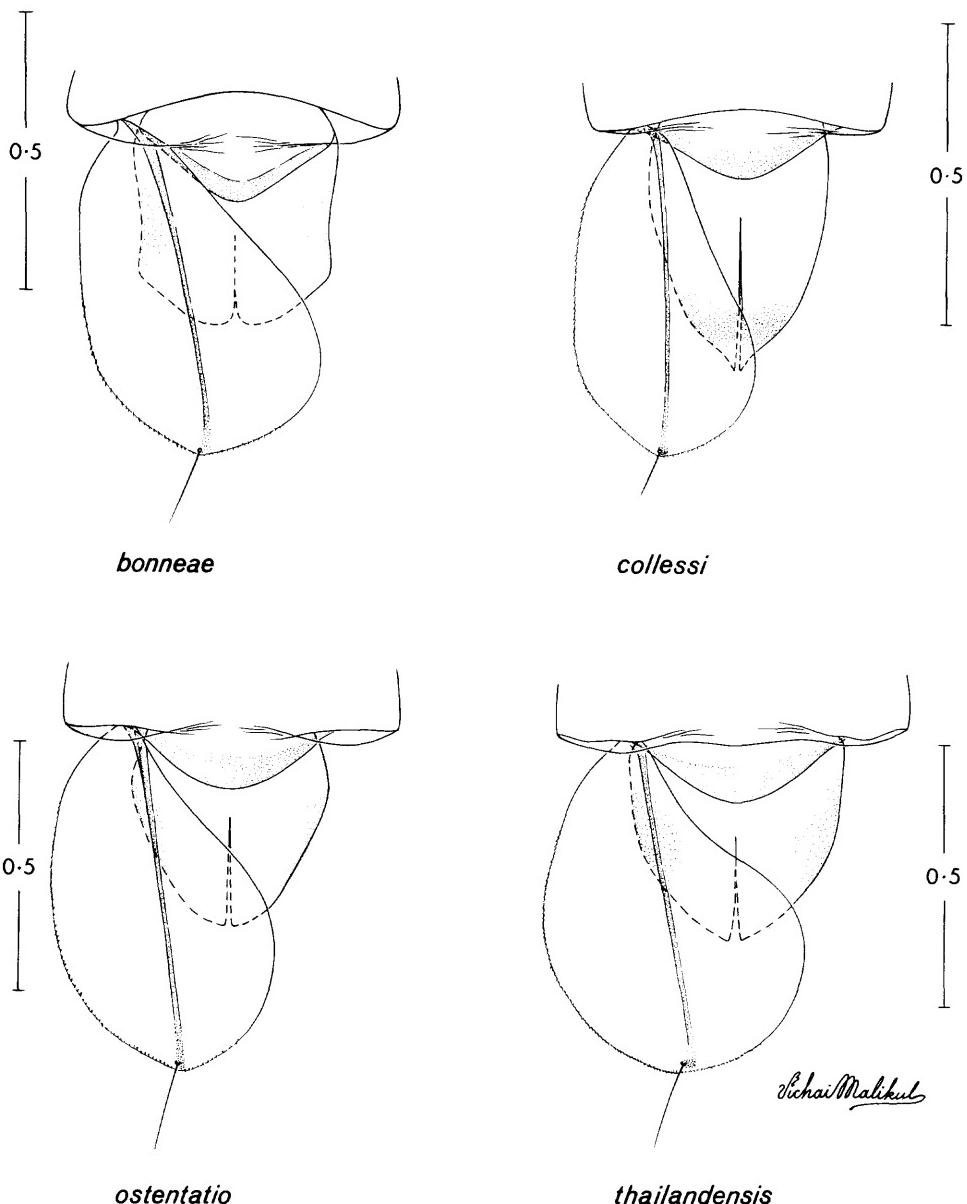
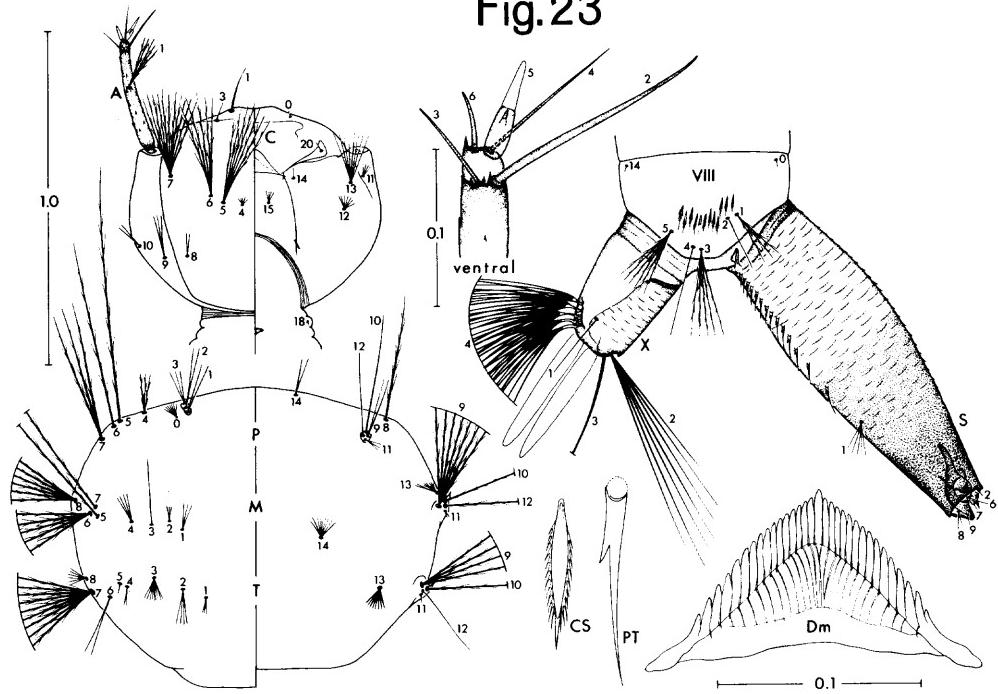
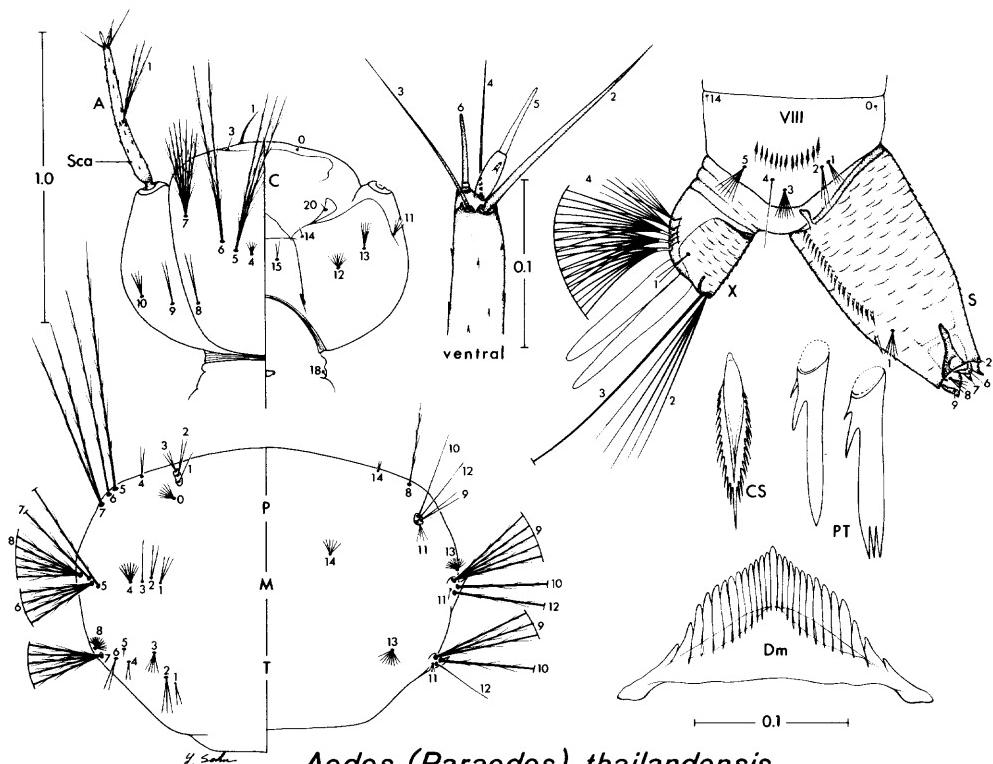


Fig. 23



*Aedes (Paraedes) bonneae*



*Aedes (Paraedes) thailandensis*

Fig. 24

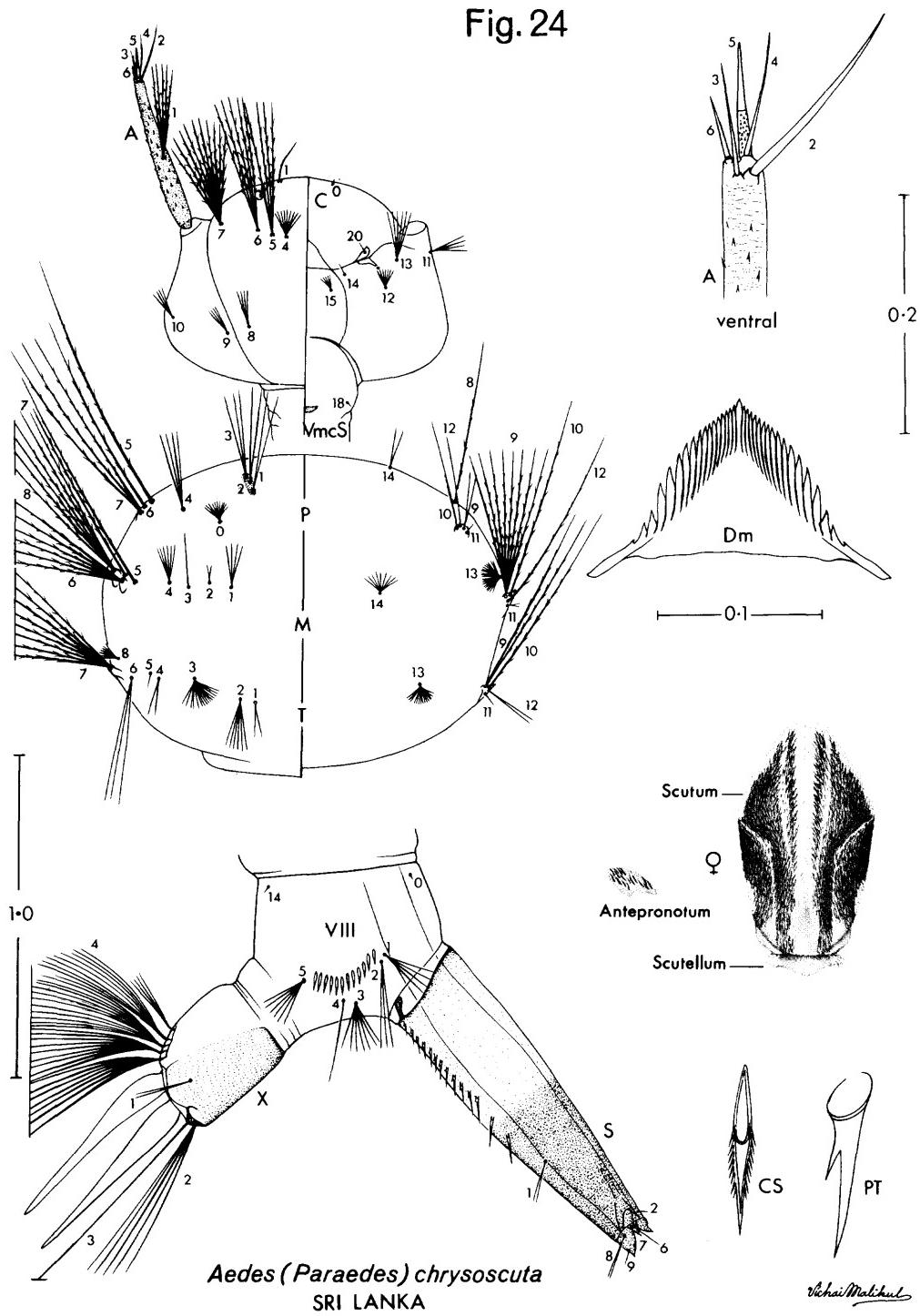
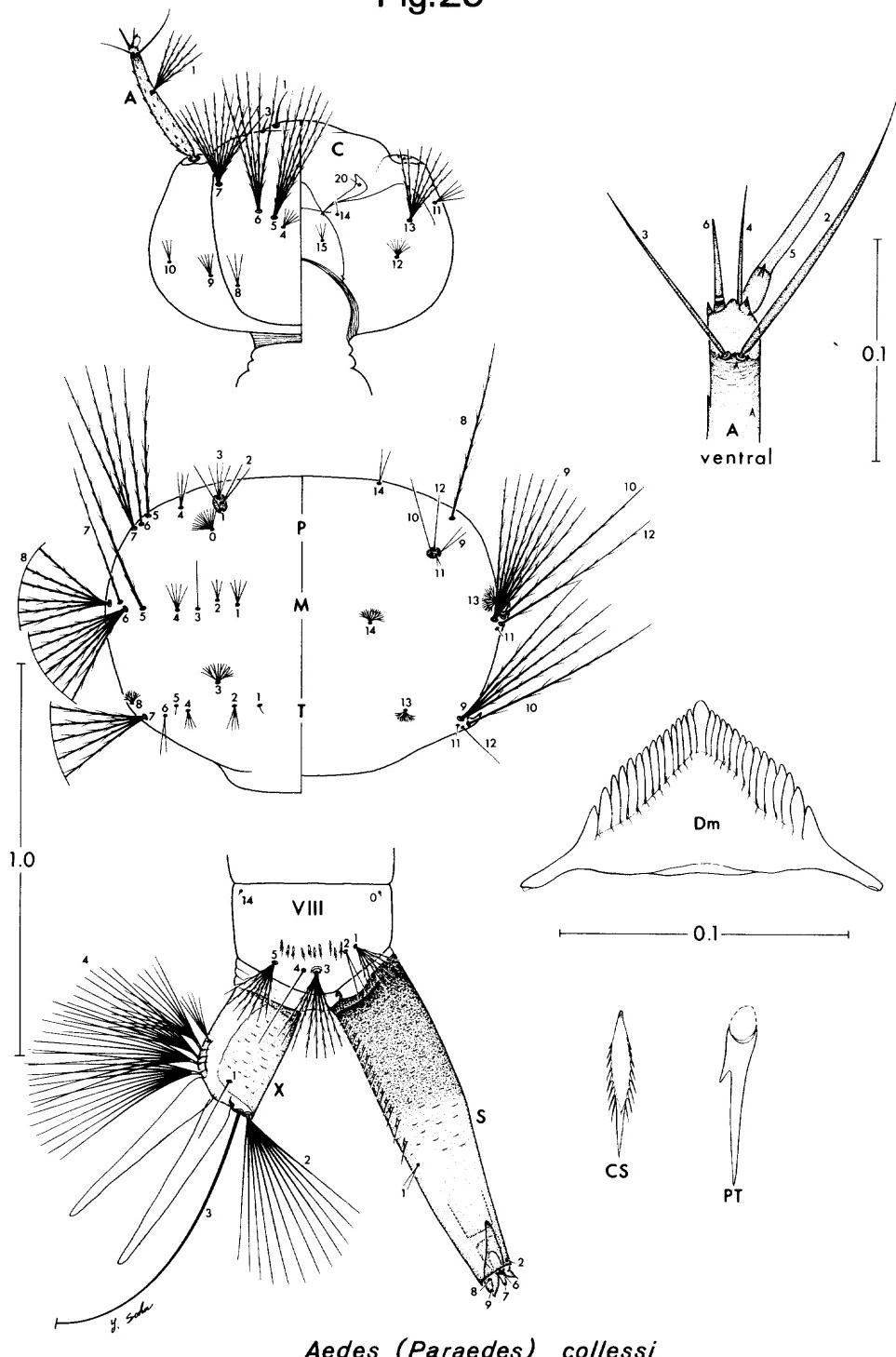
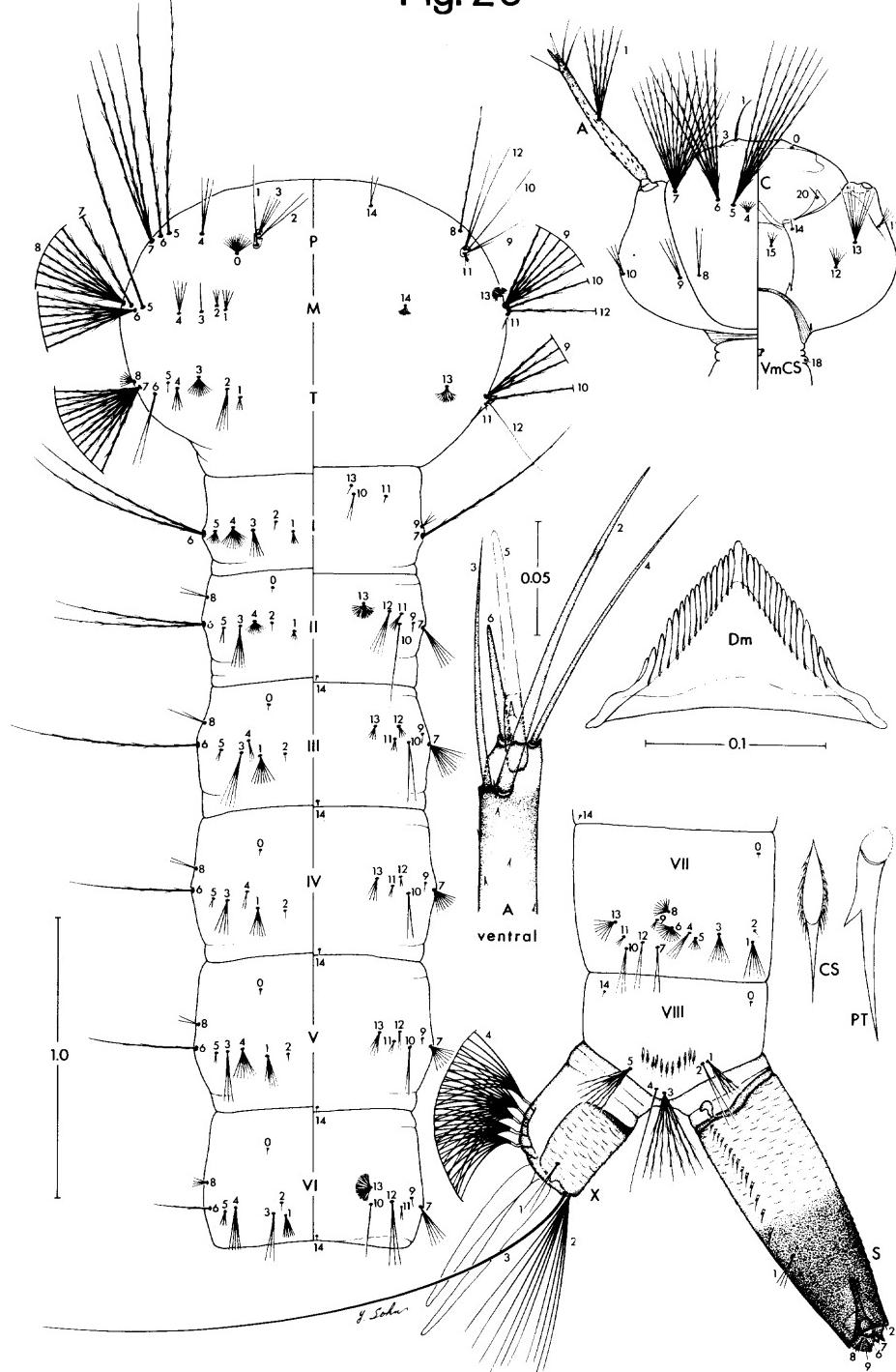


Fig. 25



*Aedes (Paraedes) collessi*

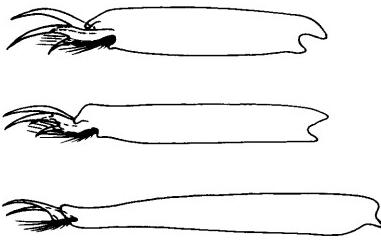
Fig. 26



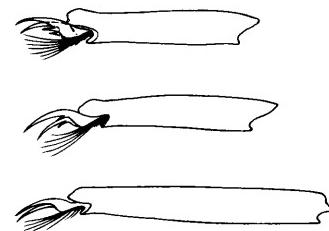
*Aedes (Paraedes) ostentatio*  
MALAYSIA

Fig.27

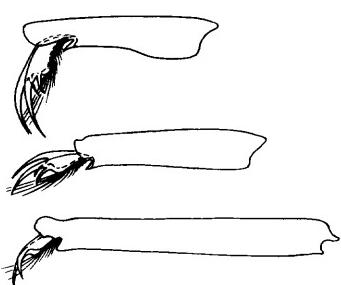
Male Tarsomeres 5 and Posttarsi



*barraudi*

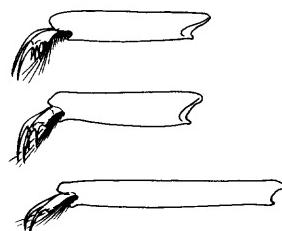


*bonneae*

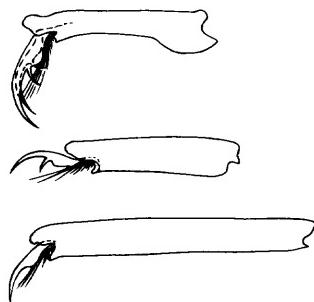


*chrysoscuta*

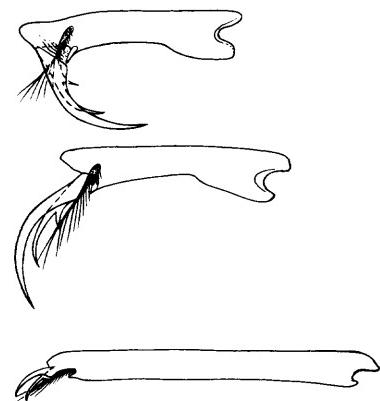
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*collessi*



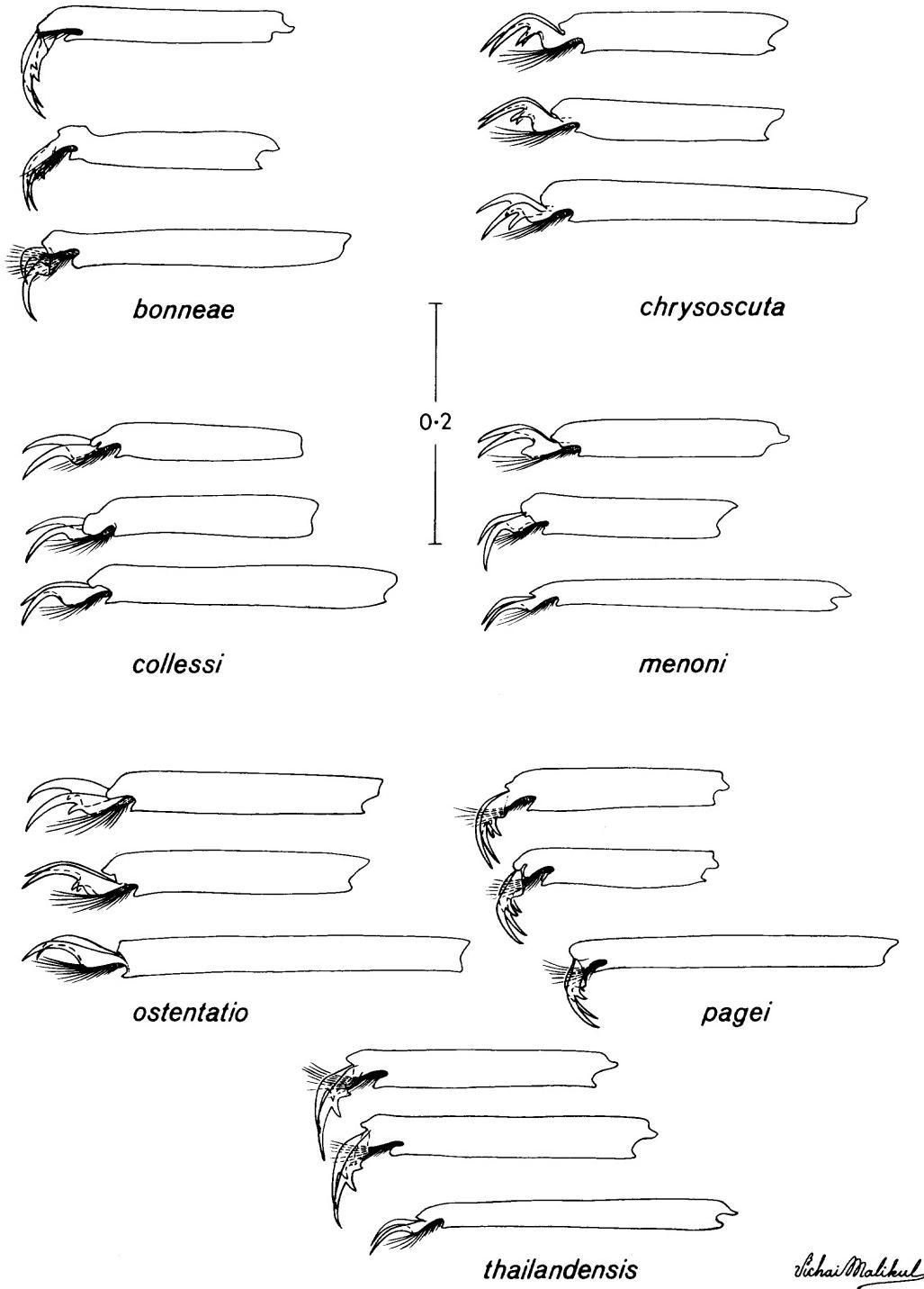
*ostentatio*



*thailandensis*

Rachai Malikul

Fig. 28  
Female Tarsomeres 5 and Posttarsi





## APPENDICES



TABLE 1. Record of the branching of the setae on the pupae of  
*Aedes (Paraedes) bonneae* (10 specimens)

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Cephalothorax			Abdomen III (Cont.)			Abdomen V (Cont.)		
1	3-5	4	1	4-10	10	14	1	1
2	2-4	3	2	1	1			
3	3-4	4	3	1	1	Abdomen VI		
4	3-6	3	4	1-4	3			
5	1-5	4	5	3-8	4	0	1	1
6	1	1	6	1-4	3	1	2-5	3
7	2-4	3	7	1-4	2	2	1	1
8	3-7	4	8	2-6	4	3	1-3	1
9	1-3	2	9	1	1	4	2-6	4
			10	1-4	1	5	1	1
Metanotal Plate			11	1	1	6	1	1
			14	1	1	7	1	1
10	3-5	5				8	2-5	3
11	1	1	Abdomen IV			9	1	1
12	2-6	3				10	1	1
			0	1	1	11	1	1
Abdomen I			1	4-9	6	14	1	1
			2	1	1			
1	21-48	28	3	1-7	5	Abdomen VII		
2	1	1	4	1-2	1			
3	1	1	5	1	1	0	1	1
4	4-7	6	6	1-2	1	1	1-3	2
5	2-5	4	7	1-3	1	2	1	1
6	1-2	1	8	1-4	3	3	1-4	2
7	1-4	2	9	1	1	4	2-4	2
9	1	1	10	1-4	2	5	1	1
10	1	1	11	1	1	6	1-4	3
			14	1	1	7	1	1
Abdomen II						8	2-5	3
			Abdomen V			9	1	1
0	1	1				10	1-2	1
1	14-22	19	0	1	1	11	1	1
2	1-2	1	1	3-6	4	14	1	1
3	1	1	2	1	1	Abdomen VIII		
4	4-9	6	3	1-3	1			
5	2-5	3	4	2-7	4			
6	1	1	5	1	1	0	1	1
7	1-4	1	6	1-3	1	4	1-3	1
9	1	1	7	2-8	4	9	1-2	1
			8	2-4	3	14	1-2	1
Abdomen III			9	1	1	Paddle		
			10	1-2	1			
0	1	1	11	1	1	1	1	1

TABLE 2. Record of the branching of the setae on the pupae of  
*Aedes (Paraedes) chrysoscuta* (10 specimens)

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Cephalothorax			Abdomen III (Cont.)			Abdomen V (Cont.)		
1	2-5	3	1	4-8	4	14	1	1
2	2-4	3	2	1	1			
3	2-5	3	3	1	1	Abdomen VI		
4	2-7	6	4	2-6	3			
5	3-6	5	5	2-4	3	0	1	1
6	1	1	6	1-4	2	1	2-5	3
7	2-3	2	7	2-5	3	2	1	1
8	4-6	6	8	2-5	3	3	1-3	1
9	2-4	3	9	1	1	4	3-6	4
			10	3-5	4	5	1	1
Metanotal Plate			11	1	1	6	1	1
			14	1	1	7	1	1
10	2-4	3				8	2-5	3
11	1	1	Abdomen IV			9	1	1
12	3-7	4				10	1-2	1
			0	1	1	11	1	1
Abdomen I			1	3-8	5	14	1	1
			2	1	1			
1	15-29	20	3	3-7	6	Abdomen VII		
2	1	1	4	1-2	1			
3	1	1	5	1	1	0	1	1
4	4-8	6	6	1-4	2	1	2-4	3
5	2-4	2	7	1-3	2	2	1	1
6	1	1	8	2-5	3	3	2-4	3
7	1-4	3	9	1	1	4	1-4	3
9	1	1	10	2-5	4	5	1	1
10	1	1	11	1	1	6	2-5	3
			14	1	1	7	1	1
Abdomen II						8	2-5	4
			Abdomen V			9	1	1
0	1	1				10	1-4	3
1	10-23	13	0	1	1	11	1	1
2	1	1	1	2-5	3	14	1	1
3	1	1	2	1	1			
4	4-9	5	3	1-3	2	Abdomen VIII		
5	2-4	3	4	2-7	5			
6	1-2	1	5	1	1	0	1	1
7	1-4	1	6	1-3	2	4	2-4	3
9	1-2	1	7	3-7	6	9	1	1
			8	2-4	3	14	1-3	1
Abdomen III			9	1	1			
			10	1-2	1	Paddle		
0	1	1	11	1	1	1	1	1

TABLE 3. Record of the branching of the setae on the pupae of  
*Aedes (Paraedes) collessi* (7 specimens)

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Cephalothorax			Abdomen III (Cont.)			Abdomen V (Cont.)		
1	2	2	1	2-3	2	14	1	1
2	2-3	2	2	1	1			
3	2-4	2	3	1	1	Abdomen VI		
4	1-3	2	4	1-4	1			
5	2	2	5	2-3	2	0	1	1
6	1	1	6	1	1	1	1-2	1
7	2-3	2	7	2	2	2	1	1
8	3-4	3	8	2-4	2	3	1-3	1
9	1-2	2	9	1	1	4	1-3	3
			10	1-3	2	5	1-2	1
Metanotal Plate			11	1	1	6	1	1
			14	1	1	7	1	1
10	3-8	5				8	1-2	2
11	1	1	Abdomen IV			9	1	1
12	2-4	4				10	1	1
			0	1	1	11	1	1
Abdomen I			1	1-2	2	14	1	1
			2	1	1			
1	17-35	28	3	2-5	4	Abdomen VII		
2	1	1	4	1-2	1			
3	1	1	5	1-2	1	0	1	1
4	6-9	6	6	1	1	1	1	1
5	3-5	4	7	1-3	2	2	1	1
6	1	1	8	1-4	2	3	1-3	2
7	1-2	1	9	1	1	4	1-2	2
9	1	1	10	1-3	2	5	1-2	1
10	1	1	11	1	1	6	1-3	2
			14	1	1	7	1	1
Abdomen II						8	1-3	2
			Abdomen V			9	1	1
0	1	1				10	1	1
1	5-14	6	0	1	1	11	1	1
2	1	1	1	1-2	1	14	1	1
3	1	1	2	1	1			
4	3-6	4	3	1	1	Abdomen VIII		
5	2-4	3	4	2-4	4			
6	1	1	5	1	1	0	1	1
7	1	1	6	1	1	4	1-3	2
9	1	1	7	1-4	3	9	1	1
			8	2-3	2	14	1	1
Abdomen III			9	1	1			
			10	1	1	Paddle		
0	1	1	11	1	1			
						1	1	1

TABLE 4. Record of the branching of the setae on the pupae of  
*Aedes (Paraedes) ostentatio* (10 specimens)

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Cephalothorax			Abdomen III (Cont.)			Abdomen V (Cont.)		
1	2-7	4	1	3-8	7	14	1	1
2	2-5	3	2	1	1			
3	2-5	4	3	1	1	Abdomen VI		
4	2-7	4	4	2-5	3			
5	3-8	4	5	2-4	2	0	1	1
6	1	1	6	1-4	1	1	3-6	3
7	2-4	3	7	2-5	4	2	1	1
8	2-7	5	8	2-6	3	3	1-3	1
9	2-5	3	9	1	1	4	3-6	4
			10	1-3	2	5	1	1
Metanotal Plate			11	1	1	6	1	1
			14	1	1	7	1	1
10	2-5	2				8	2-4	2
11	1	1	Abdomen IV			9	1	1
12	4-8	5				10	1	1
Abdomen I			0	1	1	11	1	1
			1	3-8	5	14	1	1
			2	1	1			
1	17-34	30	3	3-8	7	Abdomen VII		
2	1-2	1	4	1-4	2			
3	1	1	5	1	1	0	1	1
4	6-10	10	6	1-2	2	1	1-4	2
5	3-6	4	7	2-4	2	2	1	1
6	1	1	8	2-4	2	3	1-5	2
7	2-5	4	9	1	1	4	1-4	4
9	1	1	10	1-4	2	5	1	1
10	1	1	11	1	1	6	1-4	2
			14	1	1	7	1	1
Abdomen II						8	1-5	2
			Abdomen V			9	1	1
0	1	1				10	1-2	1
1	8-19	12	0	1	1	11	1	1
2	1	1	1	2-5	3	14	1	1
3	1	1	2	1	1			
4	5-11	5	3	1-4	1	Abdomen VIII		
5	2-4	3	4	2-7	5			
6	1	1	5	1	1	0	1	1
7	1-6	3	6	1-2	1	4	1-4	3
9	1	1	7	2-6	4	9	1-2	1
			8	2-5	3	14	1	1
Abdomen III			9	1	1			
			10	1-2	1	Paddle		
0	1	1	11	1	1	1	1	1

TABLE 5. Record of the branching of the setae on the pupae of  
*Aedes (Paraedes) thailandensis* (10 specimens)

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
<b>Cephalothorax</b>			<b>Abdomen III</b>			<b>Abdomen V (Cont.)</b>		
1	3-6	3	0	1	1	14	1	1
2	3-5	4	1	5-9	8			
3	3-5	4	2	1	1	<b>Abdomen VI</b>		
4	4-7	5	3	1	1			
5	4-8	4	4	2-3	2	0	1	1
6	1	1	5	6-11	7	1	3-6	6
7	2-5	4	6	4-8	4	2	1	1
8	5-10	9	7	1-2	1	3	2-3	3
9	3-6	4	8	2-5	3	4	3-6	4
			9	1	1	5	1	1
<b>Metanotal Plate</b>			10	3-5	3	6	2-6	3
			11	1	1	7	1-2	2
10	4-6	5	14	1	1	8	3-5	3
11	1	1				9	1	1
12	3-6	5	<b>Abdomen IV</b>			10	1	1
						11	1	1
<b>Abdomen I</b>			0	1	1	14	1	1
			1	4-8	7			
1	32-53	48	2	1	1	<b>Abdomen VII</b>		
2	1	1	3	6-7	7			
3	1-3	2	4	1	1	0	1	1
4	5-8	7	5	1	1	1	2-4	3
5	2-3	2	6	2-6	3	2	1	1
6	1	1	7	1	1	3	2-5	4
7	2-4	2	8	2-4	2	4	2-4	3
9	1	1	9	1	1	5	1-2	2
10	1	1	10	2-4	3	6	4-7	4
11	1	1	11	1	1	7	1	1
			14	1	1	8	3-6	4
<b>Abdomen II</b>						9	1-3	2
			<b>Abdomen V</b>			10	1	1
0	1	1	0	1	1	11	1	1
1	6-12	8	1	4-6	5	14	1	1
2	1	1	2	1	1	<b>Abdomen VIII</b>		
3	1-2	2	3	3-4	3			
4	4-7	5	4	5-7	5	0	1	1
5	5-9	6	5	1	1	4	1-2	2
6	1	1	6	5-6	5	9	1	1
7	3-4	3	7	4-7	5	14	1-2	1
9	1	1	8	2-8	3	<b>Paddle</b>		
			9	1	1			
			10	1-3	2			
			11	1	1	1	1	1

TABLE 6. Current taxonomic status of the subgenus *Paraedes*

Species	$\sigma^*$	$\sigma^*G$	$\sigma^{\prime}$	$\sigma^{\prime}G$	P	L
<i>barraudi</i>	**	**				
<i>bonneae</i>	**	**	**	**	**	**
<i>chrysoscuta</i>	**	**	**	**	**	**
<i>collessi</i>	**	**	**	**	**	**
<i>menoni</i>	*	**	**	**		
<i>ostentatio</i>	**	**	**	**	**	**
<i>pagei</i>			**	**		
<i>thailandensis</i>	**	**	**	**	**	**

\* = Stage has been described.

\*\* = Portion of stage or structure has been figured.

$\sigma^*$  = Male;  $\sigma^*G$  = Male genitalia;  $\sigma^{\prime}$  = Female;  $\sigma^{\prime}G$  = Female genitalia;  
P = Pupa; L = Larva

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